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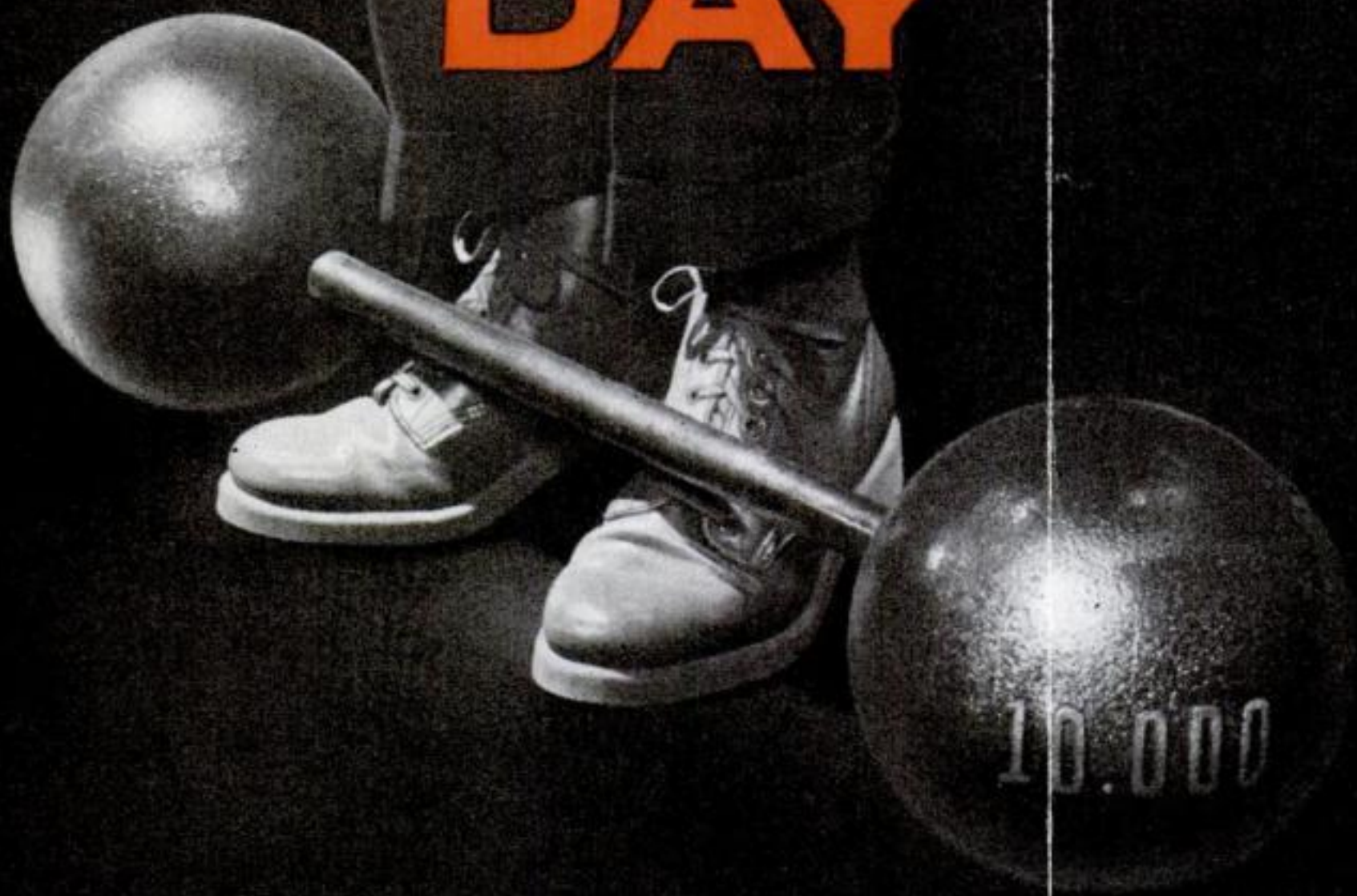


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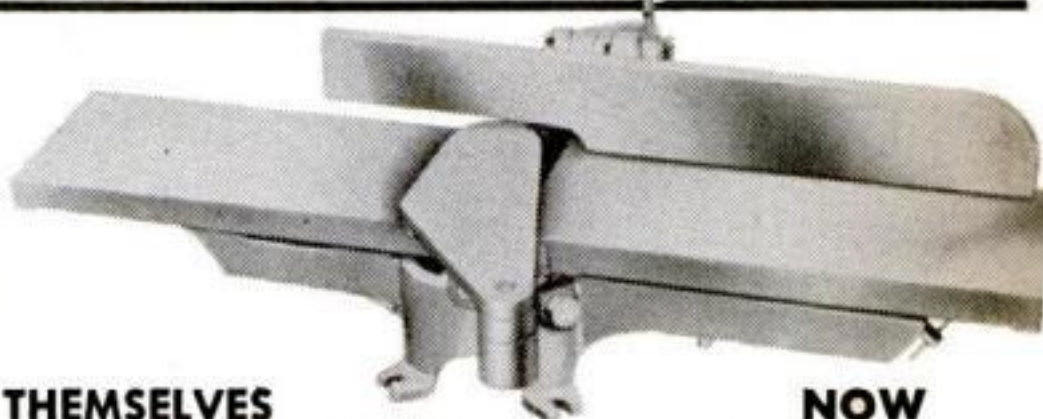
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THE MAILMAN

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ALL RIGHT, BOYS, WHAT'S THE TROUBLE?

THEY CALLED MY POP A "MUSCLE HEAD" JUST 'CAUSE HE NEVER FINISHED SCHOOL



LOOK, ANDY...YOUR FATHER'S A HARD WORKER. THAT'S SOMETHING TO BE PROUD OF!

YEAH, BUT EVEN DAD SAYS HE'S IN A RUT!



ANDY! YOU'VE BEEN FIGHTING AGAIN! OH, IF ONLY WE COULD LEAVE THIS NEIGHBORHOOD

MAYBE THIS WILL HELP... IT'S FROM INTERNATIONAL CORRESPONDENCE SCHOOLS

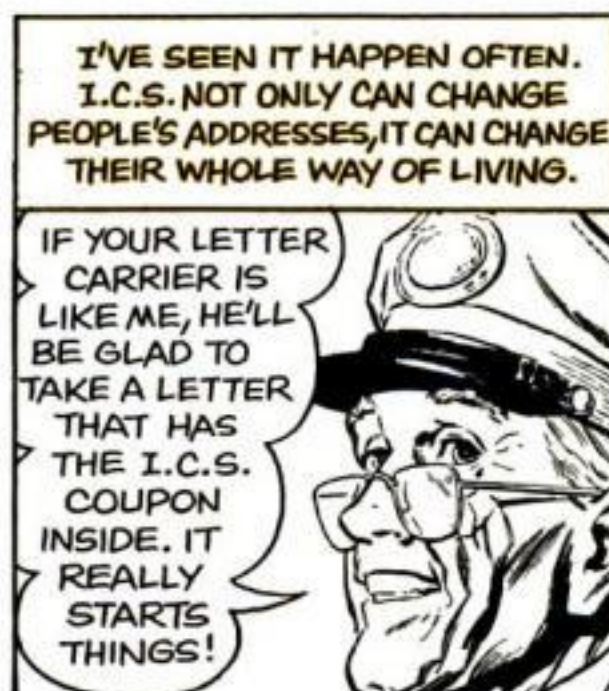


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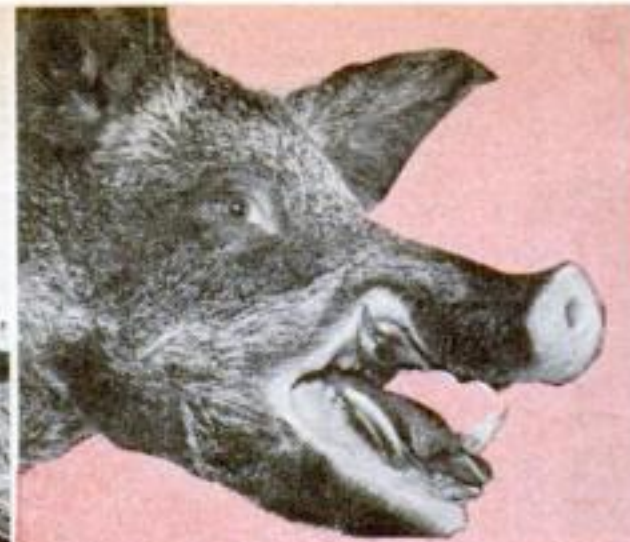
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November, 1961

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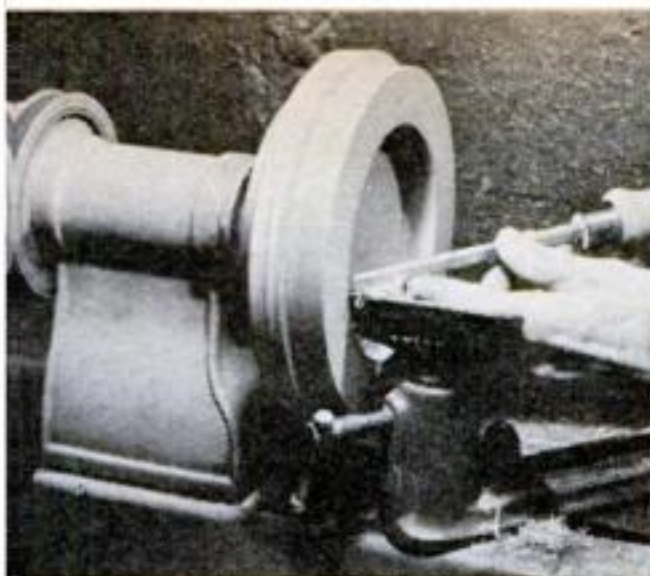
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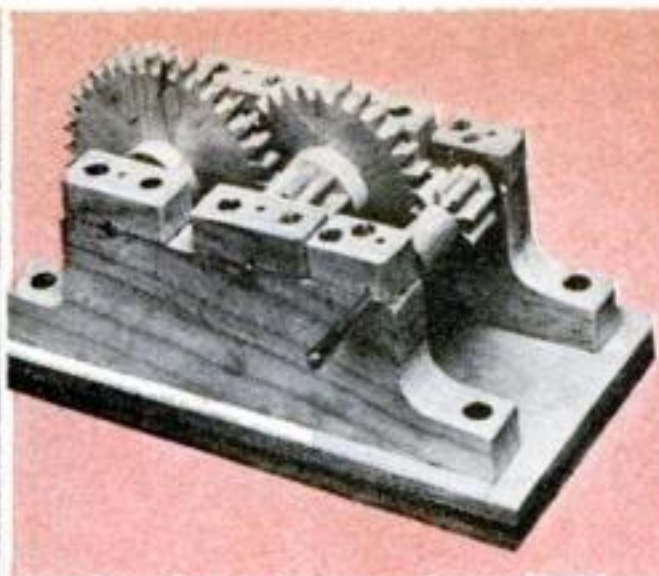
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PS Readers

TALK BACK



Balloons Down Under

"RETURN of the Hot-Air Balloon," [July] brought back pleasant memories of the Aerostatic Society at our New England University. Their balloons, similar to the 'inverted carafe' of the Wing-foot Society, really went a long way up.

Each balloon carried, attached to its wire base, a pad of cotton wool soaked in alcohol. The balloons, which were fairly large, were preheated, and at the moment of ascent the pad was ignited. There was a fairly high mortality rate for the balloons, but we're mostly gamblers down here, and many survived the ordeal-by-fire to provide enjoyable cross-country chases. No ballast was needed as the wire base was quite heavy. We found that a small hole at the top improved stability and didn't greatly impair efficiency.

G. TUCKER, Temora, Australia.

Spreading the Word

MAY we reprint in the "Commerce News Digest" the item on patents, the Patent Office, and Commissioner Ladd in "Is the U. S. Patent Office Doomed?" ["The Month in Science," Aug.]. The digest is distributed to Commerce Department officials.

Commissioner Ladd joins me in extending our sincere appreciation for your reporting and the article that resulted.

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Permission granted.

He'll Take Wheels

I DISAGREE with statements made in "1,500-M.P.H. Family Cars?" [Aug.]. I doubt that a ground-effect car could go as fast as an airplane. A GEM must keep renewing its cushion of compressed air all the time. At supersonic speeds, it would move off this cushion of air before it could be generated.

Imagine an aeromobile floating along at 150 m.p.h. in a grassy groove. Suddenly your engine quits. You plow into the earth, coming to a quick halt. What is to prevent the next car from slamming into you at 150? What kind of brakes could there be when the car doesn't touch



the ground? Reversing the thrust wouldn't do much, considering the speed.

And how could you change lanes? Surely the sides of the groove would prevent that. Having a break in the groove might cause the car to wander into the wrong groove. Even if these faults could be cleared up, I'd rather drive my car than have it drive me. Give me wheels.

RAYMOND SPENCER, Hampton, Va.

Keep Cool, Suh!

THAT iced canopy for air conditioning on the lawn ["New Ideas from the Inventors," Aug.] is a fine replacement for the electric chair. Unless some form of barrier isolates the CO₂ gas from the air within the shroud without loss of cooling, the victim will enjoy:

A) Suffocation created by lack of oxygen—the heavier-than-air CO₂ will ultimately force normal atmosphere out of

[Continued on page 10]

►► Because of our growing volume of mail, it is not possible for our staff to answer

or acknowledge individual inquiries except those published in these columns.



If you're that person, here's something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You've got to pay the price—be willing to study earnestly, thoroughly.

Still, wouldn't it be worth your while to sacrifice some of your leisure in favor of interesting home study—over a comparatively brief period? Always provided that the rewards were good—an excellent salary, job security, etc.

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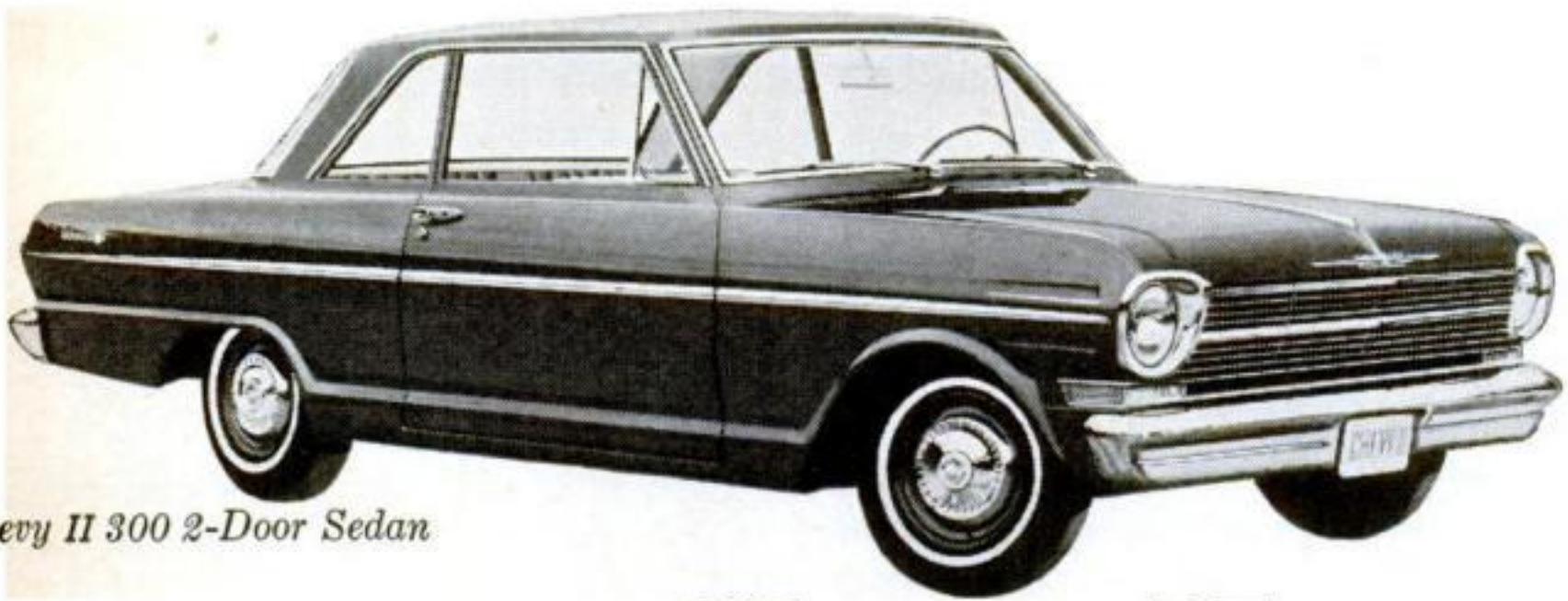
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Impala Sport Coupe

'62 Chevrolet

*Built for people who want room,
refinement and riding comfort found in
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Chevy II 300 2-Door Sedan

the new Chevy II

Built for people who want modern basic transportation in the best Chevrolet tradition. Here they are—a totally new line of thrift cars from Chevrolet, encompassing a whole new concept of engineering simplicity to clamp down on service and maintenance cost. Bolt-on front fenders, roomy engine compartment and easy accessibility of adjustable components are just a few of the maintenance advantages of Chevy II's unique design. Thrifty 4-cylinder engine (also satin-smooth 6) wrings extra miles out of a gallon of regular. Unique Mono-Plate rear springs do away with the friction and harshness of old-style springs to give you a remarkably smooth ride. These and a host of other surprises in nine spanking new-sized models, including station wagons and the soon-to-come hardtop and convertible.



A New World of Worth from Chevrolet

got the car for car minded people



Impala Sport Sedan

Here's all the car you could reasonably want. Beauty *built to stay beautiful*, from long-lived deep-luster acrylic lacquer finish right down to new rust-resisting full front fender underskirts. A choice of six engines—ranging all the way up to a 409-cubic-inch powerhouse.* A Jet-smooth ride that rivals anything high-priced cars have to offer. (The reason, of course: Chevrolet's unsurpassed combination of Full Coil suspension and more than 700 noise and vibration filters.) Whatever else you have in mind for that next car of yours, you're almost sure to find Chevrolet has been thinking right along with you. See for yourself at your dealer's.

**Optional at extra cost*



Corvair Monza 4-Door Sedan

'62 Corvair Monza

Built for people who go for sports car driving but don't go for sports car prices. Here's more that can't be copied—from the car that started the bucket seat* brigade. Bigger brakes combined with that special Corvair blend of rear-engined traction and precision steering give you an ever surer, more secure command of the road. There are saucy new styling accents and tasteful interior trim for '62. Yet—with all these refinements—the new Corvair is as sparing as ever on gas. Get on over to your dealer's and discover these and all the other delights that await you in this newest version of America's most renowned rally car. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Bucket front seats are standard on the Monza Club Coupe, optional at extra cost on the Monza 4-Door and Station Wagon.*

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HAVE WHAT IT TAKES

CRESCENT open-end and box wrenches have what it takes to get the job done quicker, easier, safer. They're drop-forged from special alloy steel for greater strength. They're made thinner for easier handling, better balance. Openings are accurately machined for sure holding. CRESCENT wrenches feel better, work better, last longer—because they're made better. See them at your nearest hardware dealer.



SEND for this 40-page illustrated booklet telling how to do the job safer, easier and better with 30 different hand tools. Tips on care and maintenance.

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the shroud, replacing it with a gas incapable of supporting life.

B) Panic caused by action of the gas on the neurophysical system.

You'd better head off the untimely passing of any of your readers who might plan to jury-rig one of these devices in the back yard.

R. G. HEMPHILL, LaCanada, Calif.

The inventor, Virgil Stark, also invented the refrigerated suit (*Frigivest*) in which vapor from containers of dry ice trickles down a wearer's body. It has been tested by the Government for military possibilities. The canopied cooler holds refrigerant in a like container, finned to conduct the vapor downward. Dry ice does drive out some oxygen, so the inventor prefers a chemical refrigerant other than CO_2 . The patent mentions only "a refrigerant such as dry ice."

Try Another Gas Station

I've noticed that very often a gasoline-station attendant holds the hose with a lighted cigarette dangling in his mouth.



Then, flicking off live embers, he asks me to turn off the car ignition but continues to hang on to his cigarette. This burns me to the same glow as his cigarette!

H. O. NELSON, Cold Spring, N. Y.

Maybe JFK Rocks Easy?


You can tell Herbert R. Pfister ["Making Your Own Kennedy Rocker," Aug.] there's a better way to attach the arms, as many a good woodworker surely observed. In one picture, it looks as if a nail is being driven through the arm and into the front post (with butt end). Even the angle bracket screwed from underneath (shown in a drawing) would have a hard time holding the arm—if you do much rocking.

Careful woodcrafters would turn a shank on the top end of the front posts, to go through an auger hole in the arm. It'd be there to stay when secured with a wooden wedge. I know from observa-

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*Kendall Refining Company
Bradford, Penna.*

tion about nails in rocking-chair arms. My granddaddy used to sit and rock away his troubles—but not altogether. He'd have to stop every now and then to hammer down the nails in the arms of his chair. This he'd do with the heavy end of his Barlow knife.

CLAUDE CALLOWAY, Gastonia, N. C.

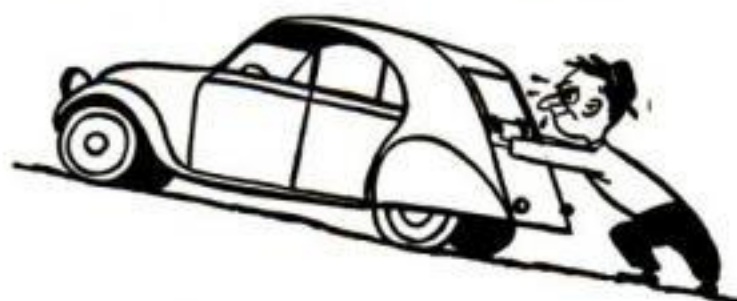
The French Flivver

THE explanation for Citroen's 2 CV designation ["France's Fabulous Flivver," Aug.] is not quite right. The initials mean more than two chevaux (two horses). The V is for *vapeur*, so CV means *cheval vapeur*, or steam horsepower. But whatever you call it, the Citroen is unique.

H. E. BROUTIN, San Diego.

... YOUR rave notices on the 2 CV Citroen are very misleading. First there's the lousy service, with an appointment at the station necessary a week in advance. The charges are high and the work on my car smells of incompetence. For almost a year I've been bothering them to correct front vibration—costs have reached near \$175 and no improvement. Installing a muffler, \$40; coil, \$15; pump, \$15.

Then performance: The most objectionable is hills it *won't* climb. I've had



police bothering me for holding up traffic. As for going anywhere, in snow it won't go uphill or even ride safely.

CHARLES KOSDEN, NYC.

Putting Quincy on the Map

TAKE a look around America. Come to little Quincy and you'll see a drilling rig being made by The Gardner Denver Co. This rig is at least first cousin to the tandem rock drills made in England and sold to Russia [June, p. 210]. What's more, in my home town you can see the world's largest pump being made, too.

CLARKE BOWMAN, Quincy, Ill.

Easy Start for a Mower

I HAVE a 2½-hp. Sears mower and I also wanted an electric starter ["Power

CONTINUED

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SAVE
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Limited time only at
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Chest contains all these
genuine DeWalt tools



Plywood Saw



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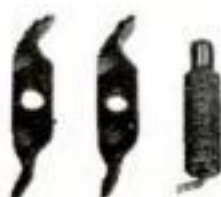
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This is the biggest bargain you've ever had! Now, with your purchase of a new DEWALT POWER SHOP, you can get a custom-made steel chest complete with select tools...33 pieces in all...and all are genuine DEWALT brands that shopwise men use for quality work. Buy this great combination...DEWALT plus CHEST FULL O' TOOLS and SAVE BIG \$66.45. For limited time only. Hurry to your DeWalt dealer and take home your biggest buy ever.

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☐ Send me special Chest Full O' Tools information.

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Starter for a Power Mower," June]. All I did was remove the starter assembly and put the nut back on the shaft. Then I took a spark-plug wrench that fit the nut, and cut it down to about 3". I turned a shaft that fits inside the wrench and has a 1/4" shank to fit my electric drill. To start, I chuck the wrench in my drill, stick it on the nut, and pull the drill trigger.

There's a bonus, too. With the starter assembly removed, the mower motor seems to run cooler because it gets more air from the top.

JAMES STOVALL, Danville, Ill.

Baby Gas Sippers

WHEN reading the scooter roundup ["Tiny Two-Wheelers Run All Week on a Gallon of Gas," Aug.] I was amazed that you left out the Cushman and stated that most scooters cruise at 30. My own Cushman Super Eagle will cruise at 50 all day. Top speed is 60.

ALLEN McDONALD JR., Valliant, Okla.

Our article discussed the diminutive rigs—scooters under \$300. The cheapest Cushman doesn't fall into this category.

Send Along a Haunch or Two

WHEN discussing fabulous animals ["From the Loch Ness Monster to the Giant Squid," June], you forgot a very important one known to every boy: The Snipe. As a Boy Scout, I've been on



many a snipe hunt and, although the critters have always eluded me so far, I understand that the meat is delicious.

GREG CLARKE, Norman, Okla.

... SOME time back, you ran a picture you said was a "purported photo" of Scotland's famous sea monster ["From the Loch Ness Monster to the Giant Squid," June]. Though late, I have some news for you. The other night, between reels

CONTINUED

LOOKING FOR LONG WEAR IN SAFETY SHOES?

TRY HY-TEST SHOES WITH NEOPRENE SOLES!



Stock No. 922

HY-TEST
SAFETY SHOES
a Division of
International Shoe Company

The safe-sure protection of the steel anchor flange box toe—soft-tread comfort of a cushioned arch insole . . . extreme flexibility . . . just about every feature you could want in a safety shoe, you'll find in HY-TEST safety shoes.

And you can expect to enjoy all these features longer because HY-TEST shoes provide extra long wear. Their rugged, resilient soles and heels of Du Pont neoprene strongly resist oil, grease, chemicals and cold weather cracking.

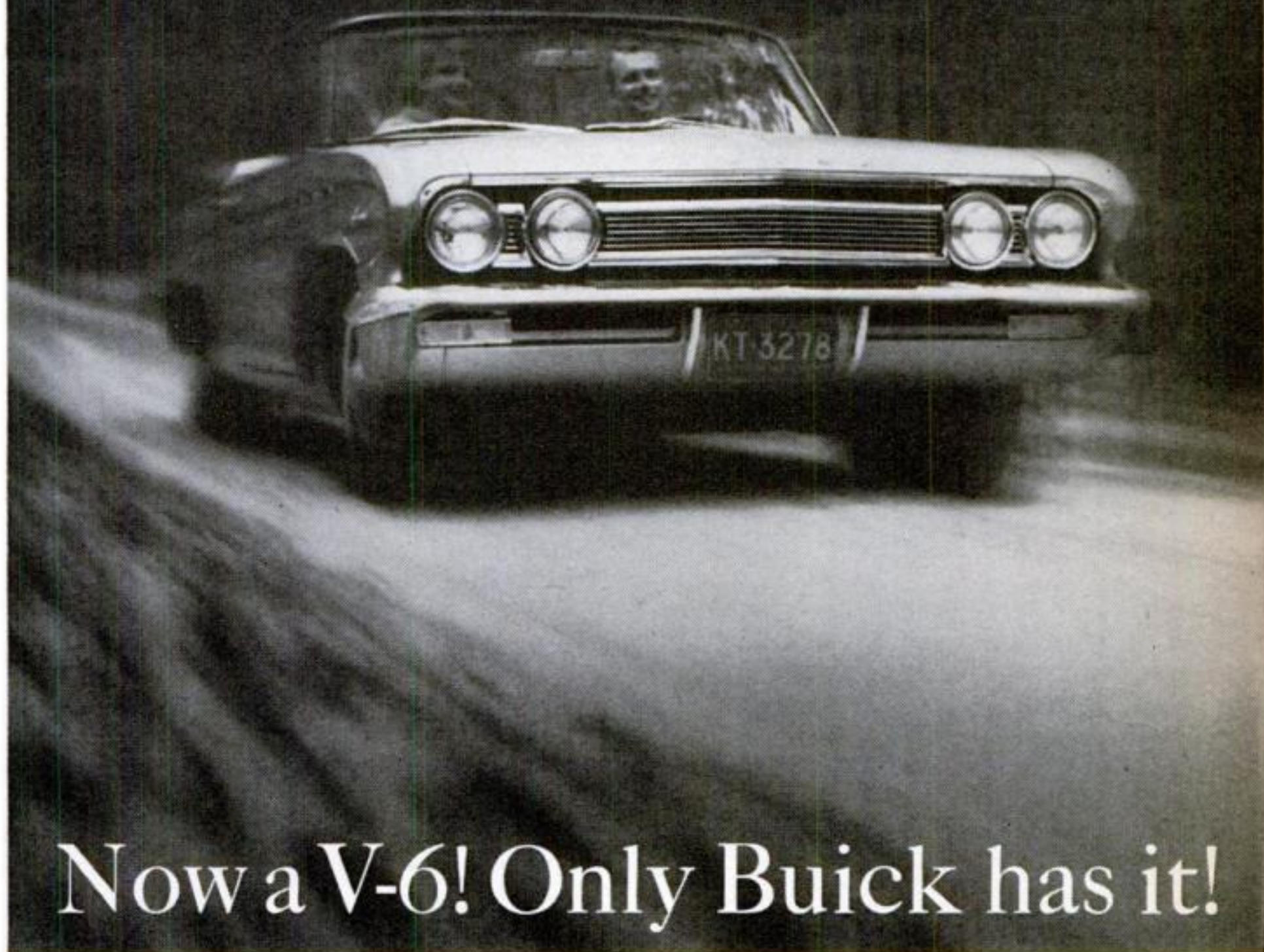
Neoprene has been job-proved under the toughest conditions. That's why it is used in so many fine work and safety shoes.



BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

Ask for neoprene soles the next time you buy safety shoes

a great new power mate for the Special's aluminum V-8



Now a V-6! Only Buick has it!

Six for Savings—V for Voom. It was natural that it came from Buick. Natural that Buick developed the successor to the in-line six-cylinder engine...*the V-6!* A V-6 you can now get in the new 1962 Buick Special (in convertible, sedan or station wagon models). A V-6 that has 140 to 179 pounds less weight than in-line sixes of comparable power. A V-6 that gives you the V-smooth, V-lively *Voom* of big cars *plus* gas economy that challenges the compacts. A V-6 with the shortest, most rigid block and crankshaft in any American 6-cylinder car.

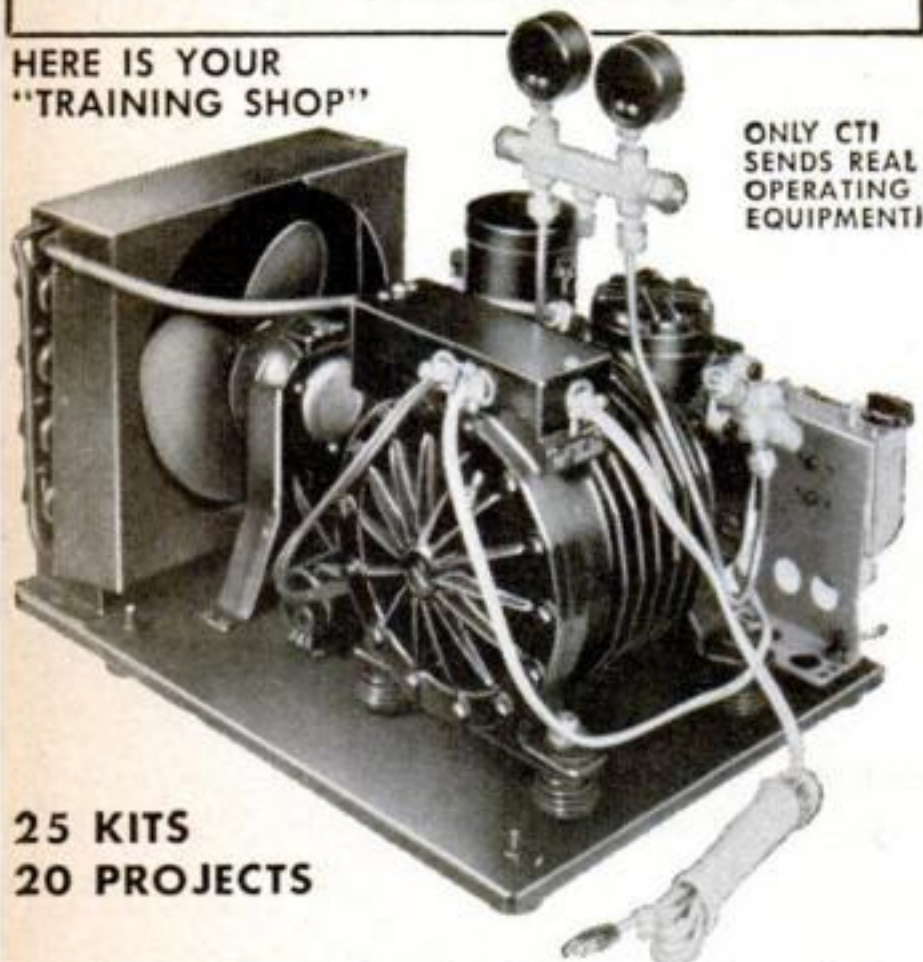
Why is it natural that this great engine should

come from Buick? Because it was Buick which also developed an *aluminum V-8* which you can also get in the Buick Special. This is the V-8 that gives you sizzling go, yet swept its class in 1961's Mobilgas Economy Run against the country's top drivers. It's natural that it should come from Buick, too, because so many other great automotive advances *have . . .* such as today's safe, simple directional signals . . . fin-cooled aluminum brakes . . . the first no-shift transmission . . . the first hardtop. So here again you have exciting proof that when better automobiles are built, Buick will build them. Buick Motor Division—General Motors Corporation.

'62 Buick Special 
The happy-medium size

CTI MAKES IT EASY FOR YOU TO MAKE GOOD

HERE IS YOUR
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Train at home with this unit for a big-
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AIR CONDITIONING AND REFRIGERATION

No industry offers you more opportunities, better pay and greater security than air conditioning and refrigeration. The field is growing so fast that 20,000 new mechanics must be trained each year. Most office buildings, shops and factories are now built with air conditioning. The 150 million old refrigerating units need periodic repairing. Get into this gigantic, uncrowded field. It offers more jobs, less competition!



Learn at home by practicing. Get experience as you train. CTI sends tools and parts to build a 1/4 hp commercial-quality condensing unit. You complete 20 field-type projects. You build an air conditioner, freezer, refrigerator or milk cooler. Many students earn money installing and fixing units — often enough to pay their tuition.

Mail coupon for Catalog, Lesson Samples and a new booklet, "Proof from Graduates." Discover how big your opportunities really are—how you can master this rewarding craft to qualify for a top-pay job. Learn how you can go in business for yourself in domestic, commercial or auto air conditioning. Act now!—Commercial Trades Institute (a non-profit organization), Chicago 26, Ill.

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of movies, my son produced just such a sea serpent on our movie screen. We now believe we have the explanation of what the camera caught in that "pur-



ported photo": a submerged swimmer with one arm and part of his body extending above the surface.

R. E. STINSON, Mayfield, Mich.

Caught with Our Filters Down?

THE infrared lamp you say sends dark-of-night signals that can be picked up with special goggles ("The Faceless Army," Aug.) is not infrared. The units pictured are part of Signal Lamp Equipment SE-11. There is merely a red filter over an intense light. The goggles, too, are fitted with red filters.

The cord does not run back to the power supply, but is used for remote signaling.

J. L. DEPASQUALE, Angola, N. Y.

Riding a Saucer

THE Evinrude people are professionals at making motors, but definitely amateurs at riding disks ["A Homemade Substitute Saucer Skimmer," Aug.] The disk tends to move each time you move your feet. Thus it is much easier to start by standing up on the disk.

I have been riding a disk for three years and have taught many others to "come out standing up," this way:

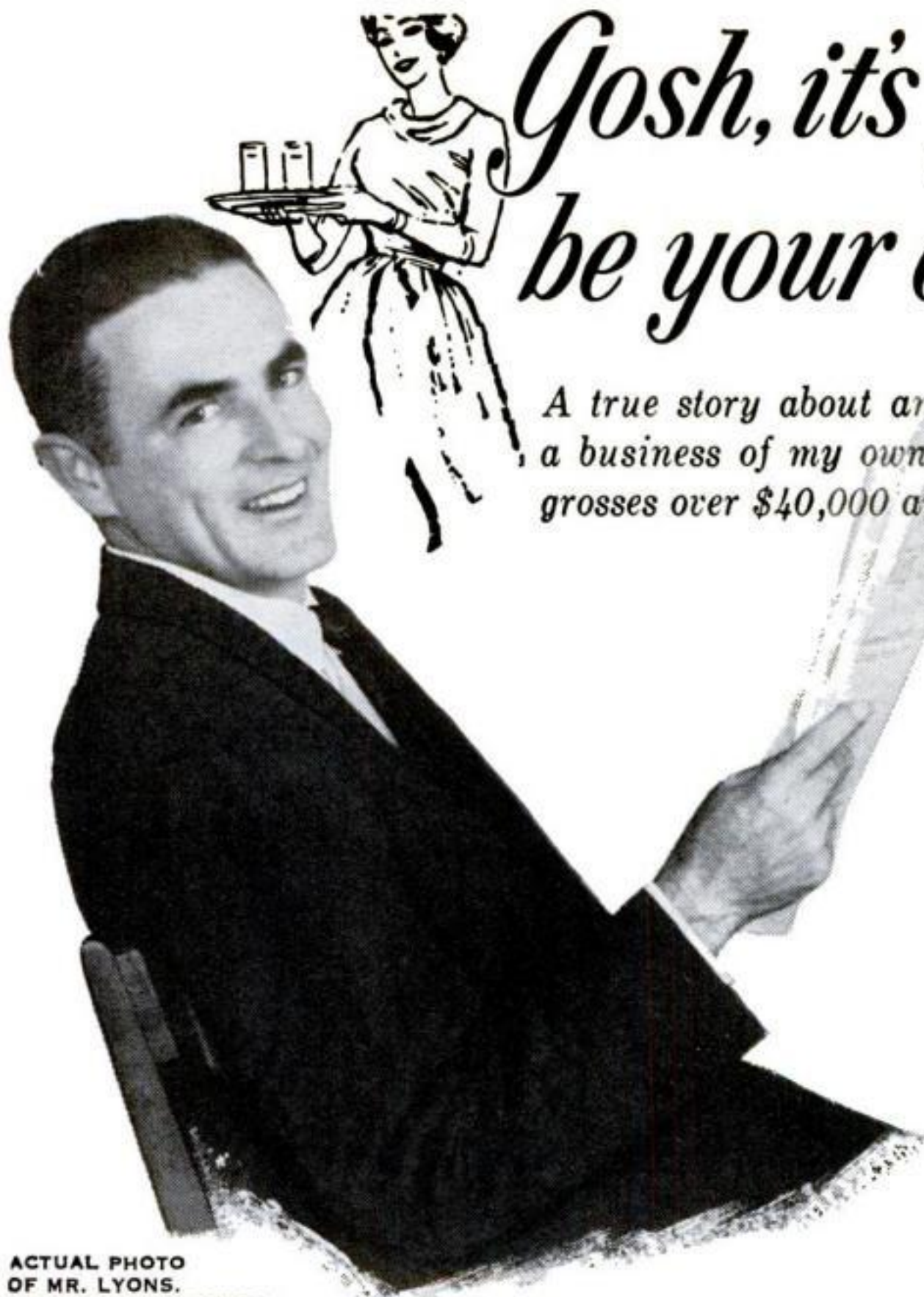
1) Get ready: Hold rope in right hand across disk much as in your first picture. Have rope slightly taut.

2) Suddenly push down rear of disk, placing feet on the disk, and call to boatman to go. He accelerates as rapidly as possible until 10 or 12 m.p.h., then levels off at that point.

3) Stay in the boat's wake.

4) In turning around, keep body lean-

[Continued on page 20]



ACTUAL PHOTO
OF MR. LYONS.
ADDRESS ON REQUEST.

by Michael J. Lyons

Gosh, it's good to be your own boss!

A true story about an ad that got me started in
a business of my own three years ago—that now
grosses over \$40,000 annually!

Easy to Get and Keep Customers

Your success in this field is charted with a tested sales program set up by the company. First, it teaches you how to *get* customers. And when we get customers, we *keep* them because of Duraclean's fine advantages. Folks rave most over our no-scrubbing, no-soaking features which mean rapid drying and no-shrinking or texture distortion.

6 Ways to Make More Money

Money-making opportunities are not only in cleaning. You have 5 other services: soil retarding; moth-proofing; spot removal; minor carpet repair; flameproofing... and 15 home care products to sell, at a nice profit.

Security a Grand Feeling

As I start my fourth year as a Duraclean dealer, I have a profitable repeat business—satisfied customers who keep coming back for more!

If you're looking for this kind of opportunity, write Duraclean, as I did. They'll send you the facts free. No one will call on you until you *ask* for personal advice. Just fill in the coupon—this may be *your* big chance, too!

Backed by 3 famous awards

Mail coupon today for free booklets!

DURACLEAN COMPANY
1-18N Duraclean Bldg., Deerfield, Ill.
Please rush FREE booklets which detail how I may own my own business. I understand I am under no obligation and no salesman will call.

Name.....

Address.....

City.....State.....

It sure is a wonderful feeling to be your own boss and know the sky's the limit if you're willing to get in and pitch. I know, for I've been on both sides of the fence.

I'd been watching for just the right thing when I spotted an ad offering a Duraclean rug and upholstery cleaning dealership.

Now, just three years since I saw that ad, I have my own \$40,000-a-year business.

I investigated the company and found it to be a top level firm respected in the field since 1930.

Unlimited Market Potential
I found that the money-making pos-

sibilities in this field are endless. The Duraclean process itself—its safety and efficiency—told me that here was the right combination to make it BIG.

Easy to Start—Training Free

It's easy to get started with Duraclean. Everything is provided—and a complete training course helps you build your new business.

You don't need a shop since cleaning is done in the customer's home or place of business. And with wall-to-wall carpet so popular, "on location" cleaning is really a *must*!

EXCLUSIVE ONE-PIECE CAB-BODY DESIGN gives Ford Styleside pickups extra capacity, extra strength. Heavy duty in every way for heavy going all day. Car-like ride, too!



THEY'RE HERE!

NEW '62 FORD TRUCKS

Get full-time economy that only starts with Ford's low price!

Meet the trucks that make saving money a full-time business — new Ford Trucks for '62!

In a selection of over 600 models there's a truck that's just right for your job, whatever your job . . . a truck that can

save you money, mile after mile, load after load, year after year!

You save on price. You save on gas and oil. You save on tires, on maintenance—wherever there's a way to save! The full record of Ford economy,

covering three years of independent tests, is in Ford's Certified Economy Reports. See your Ford dealer now. Check out the facts, work out a deal, and drive out a truck that saves money . . . full-time!

**FORD TRUCKS
COST LESS**

SAVE NOW...SAVE FROM NOW ON

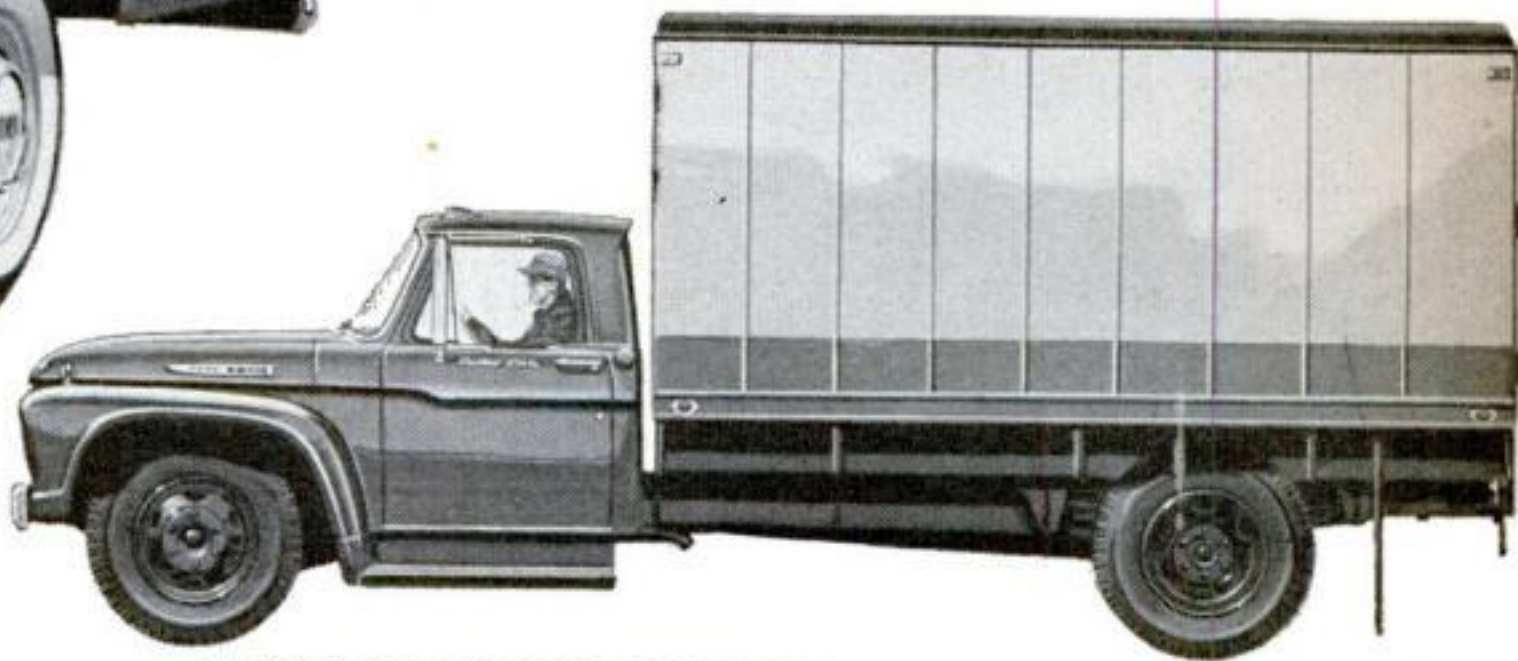
FORD
TRUCK
CERTIFIED
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AMERICA'S MOST POPULAR VAN — and small wonder! Econoline savings start with a price far under any conventional panel on the market! And they continue every day—certified tests have shown that in just 16,000 miles, savings in operating costs can top \$100! Big 4-ft. doors rear and curbside, 204 cu. ft. of loadspace!



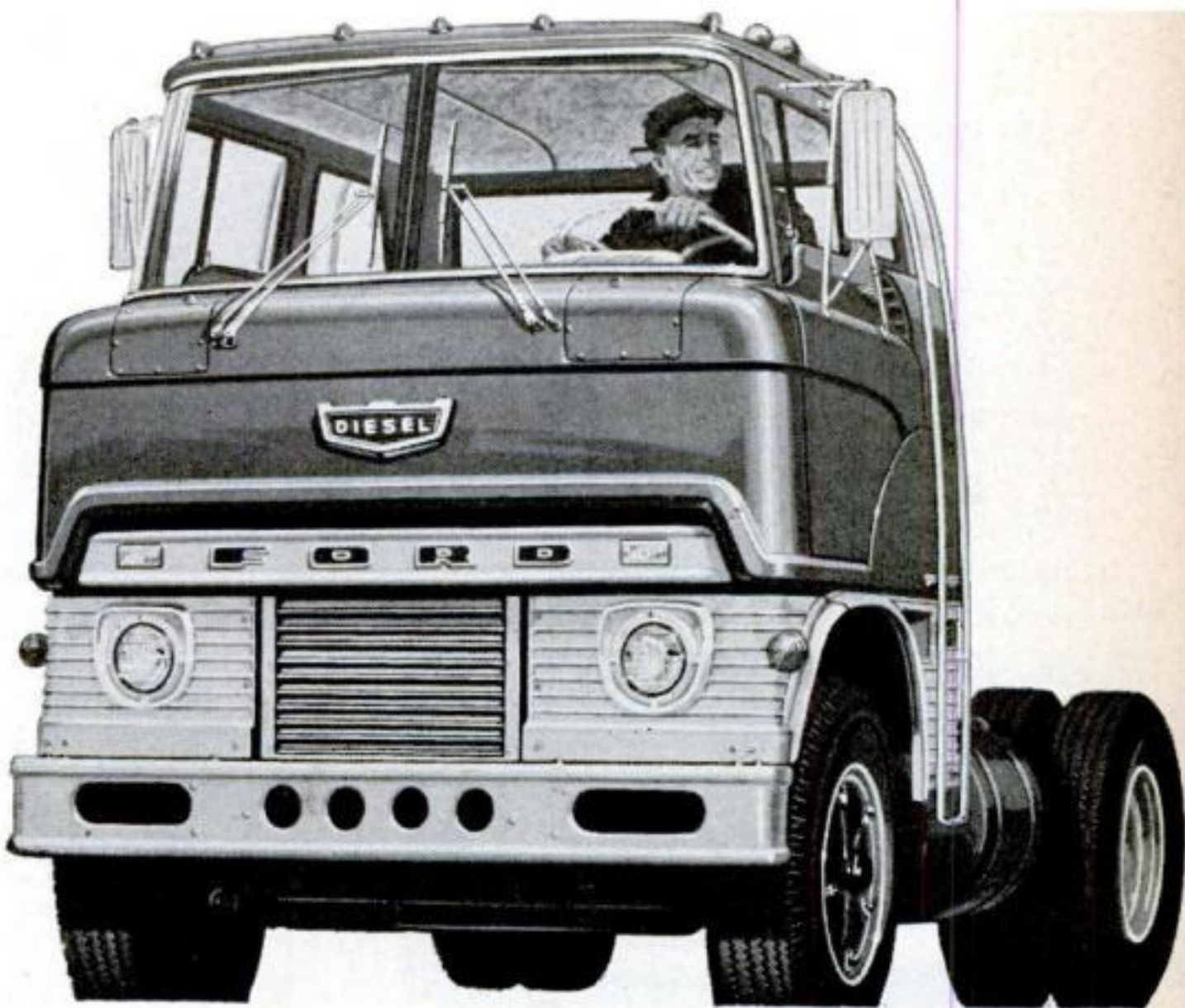
ECONOLINE—ALL-AROUND ECONOMY LEADER—can cut operating costs \$100 yearly! Carries $\frac{3}{4}$ ton with up to 23% more loadspace than conventional 6½-footers. And the loadspace is all usable—the floor is flat, there's no rear-engine hump!



NEW BIG SIX FOR FORD MEDIUMS has more heavy-duty engine features than any other Six of its size! Never before such long-term reliability and economy!

SUPER DUTY V-8 OR DIESEL power gives Ford's new highway tractors superb performance. Optional sleeper cab adds only one inch to cab length, allows 40-foot trailers in 50-foot over-all length. GCW's up to 76,800 lbs.

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every home needs all **3**

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is pocket-size for quick, handy measuring. 6-8-10-12-ft. lengths. 10-ft. \$1.69



RIGID!

RED END® WOOD RULE

is the carpenter's favorite. 6" brass extension. Markings aren't just painted on, they're embedded in wood. 6-ft. \$2.50



LONG!

BANNER® 50' TAPE

lets you do long-distance measuring by yourself. White Clad® steel line glides on double rollers. 50- or 100-ft. 50-ft. \$5.49



Look for Lufkin measuring tools wherever you buy hardware or building supplies.

measure for measure,
the finest made

LUFKIN

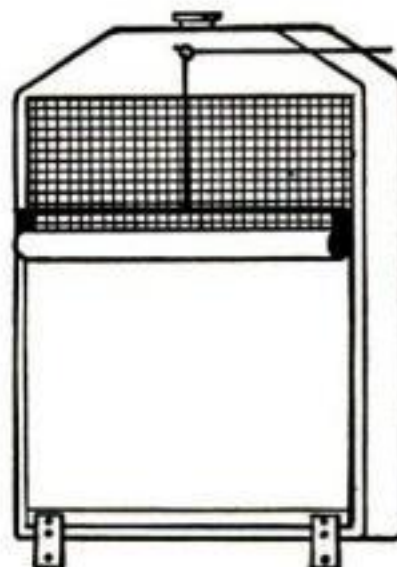
SAGINAW, MICHIGAN

ing away from the boat to keep front of disk up at all times. If you fall, just dive in head first.

REV. E. F. LEACH, Stephenville, Tex.

Hastening Warmup

A MODEL-GARAGE Hint last winter [Nov. '60] described a pulley hookup for a window shade in front of a car radiator. You raised it by pulling a string run through pulleys to a bracket under the dash. With this system, fan suction surely would prevent lowering the shade except when the motor is off. I think I've worked out an improvement:



Suspend the roller from a flat strip of iron formed into a yoke. With the string tied to the center of this hanger, you can lower the shade even while driving at reasonable speed.

A. BERG-HANSEN, Oslo, Norway.

Out of Court

A PICTURE and caption in your August issue [p. 79] erroneously describe a closed-circuit TV system as used by a Dearborn judge to let minor traffic offenders pay fines without leaving their cars.

Actually, what took place was a four-day experiment conducted without authority from the Dearborn Municipal Court when court was not in session, and no court personnel, police officers, or traffic violators participated.

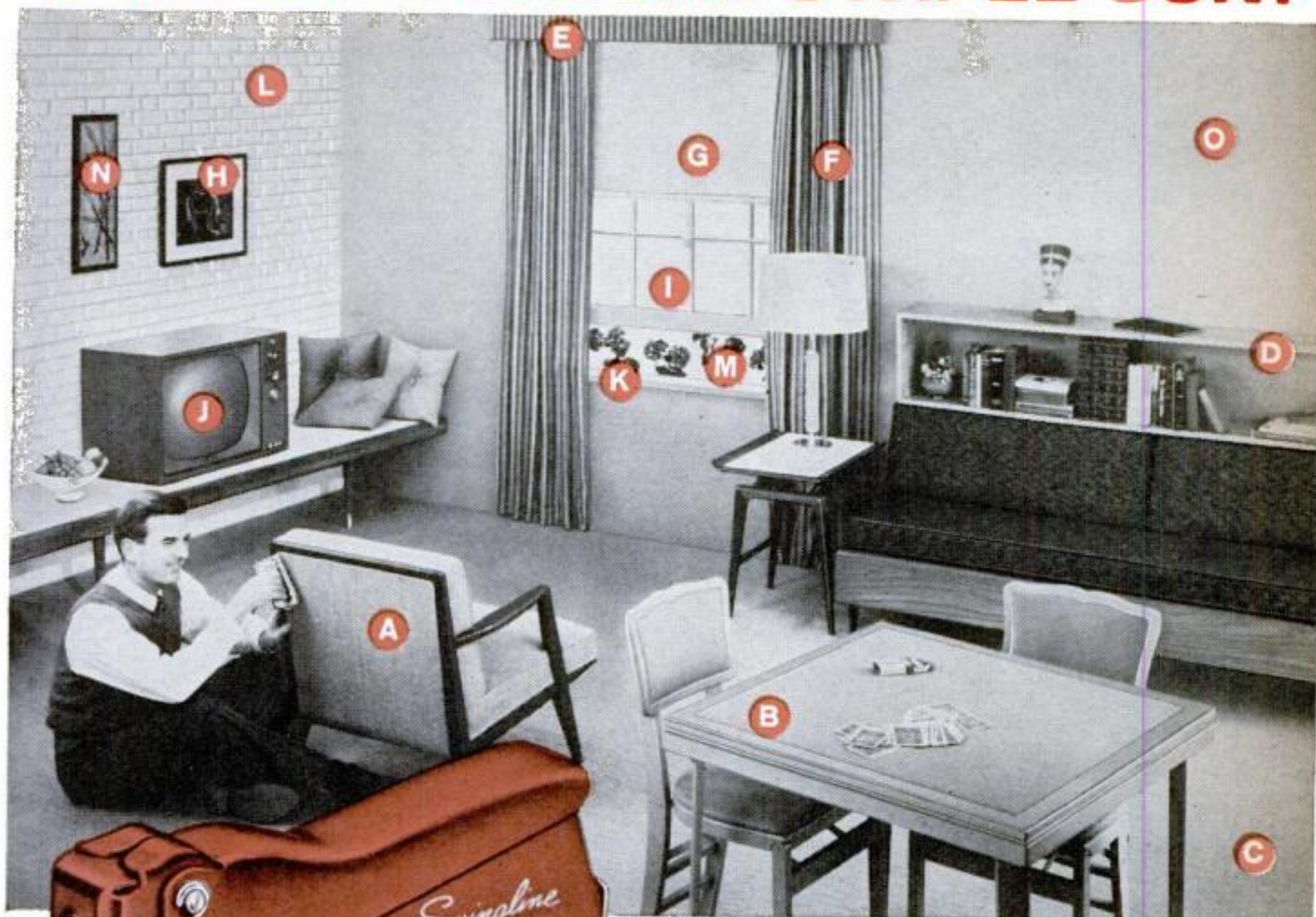
The American Bar Association does not approve or sanction TV use in a courtroom and further does not approve making traffic tickets into either a commercial transaction or a publicity stunt.

GEORGE T. MARTIN
Presiding Municipal Judge
Dearborn, Mich.

How to Ride a Bike

How inefficiently teen-agers use their bicycles today! Even though they get physical education at school, they are taught nothing on the correct use of the fine equipment they own. They ride with feet "flat" on the pedals, losing the greater leverage and better physical develop-

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ONLY \$ **4.95** with
**PUSH-BUTTON
LOADING**

A SWINGLINE staple gun makes *immediately possible*—and *easy*—all those time consuming, hard-to-do chores both inside

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- Handle lock •
- Push-button • loading
- Rugged, heavy-duty • steel construction
- Load indicator •
- Open channel • takes 2 staple sizes: 1/4" and 5/16"

CHECK THIS LIST

- A—upholstering furniture
- B—recovering card table and chairs
- C—installing carpeting
- D—shelf trimming
- E—valances
- F—hanging drapes
- G—window shades
- H—matting pictures
- I—window screens
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- L—installing plastic wall brick
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How to do many
stapling jobs.



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Long Island City 1, New York
World's Largest Manufacturer of Staplers For Home and Office!

ment possible by using the ball of the foot. Unfortunately, too, toe clips for correct foot position are unknown today. Knees pump up and down and almost



bump the rider's chin in a grotesque parody of the easy, efficient style possible with correct saddle height.

A few months ago, I found a lightweight diamond frame and a saddle made entirely of leather. I made toe clips and fixed them to the pedals, adjusted saddle and handlebar to fit myself, and did away with all the added weight of surplus equipment. It's a joy to ride!

W. V. CLAUSSEN, Silver Springs, Fla.

English or African?

PAGING through the July issue, I saw the short bit on what you call a "new

English sports car" ["Picture News," p. 50]. The GSM Delta was designed and built by three South Africans: Bob van Niekerk, Willie Meisner, and Verster de Wit. It has been sold here for several years under the GSM Dart label. The factory is at Bottlary, Stellenbosch.

The U. S.-export model of this South African car, called Delta, is assembled in England to save freight cost.

A. S. LE ROUX, Huis Visser, Stellenbosch, R.S.A.

Body and chassis components of the Dart were originally manufactured in South Africa, but the Delta is now made in its entirety in England.

Case of the Backward Engine

SOME of the letters from old-timers in the automobile field bring to mind an experience of my own. Back in 1907 I had to design a new four-cylinder, four-cycle engine to go into a car for the Automobile Show that year. It was a rush job with nobody to check each drawing.

Finally the day came when everyone concerned gathered round and I started

[Continued on page 27]

Brand-New from J.C. WHITNEY & CO.—FIRST WITH THE LATEST AT LOWEST PRICES!

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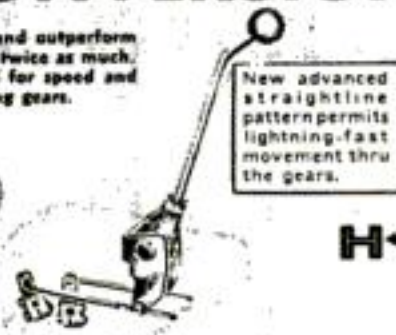
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Will outlast and outperform shifts costing twice as much. Spring loaded for speed and ease of shifting gears.



New advanced straightline pattern permits lightning-fast movement thru the gears.

LOW: Pull back as with regular shift.
2ND: Straight forward.
HIGH: Straight back.
REVERSE: Push hard left & forward.
THIS
H ← NOT THIS

NOW ONLY \$19.95

FOR ALL CARS with Standard or Overdrive Transmissions



This new Straight-H Speed Shift Conversion has been precision engineered for positive, instant-action shifting. Designed by speed specialists, this advanced straight-line pattern permits lightning-fast movement thru the gears without moving a gear. Assures faster shifting, faster acceleration, and faster drag times. Just check over the outstanding exclusive features this new floor shift conversion kit has:

Narrow Straight-H Pattern Straight-line action eliminates the wide neutral gate (see diagram above) and slow zig-zag "monkey-motion" found in conventional "H" patterns.

Dual Spring Loading Two high tensile compound springs store more energy (adjustable up to 40 lbs.) for quicker, more positive "snap" shifting.

Shift Stick Travel Adjustment Shift lever travel (stroke distance from gear to gear) may be lengthened or shortened to suit height of operator and style of driving. This exclusive feature is available on all kits for Fords and other make cars.

Self-Aligning Pivot Box Exclusive design includes a TWO-WAY MOTION Pivot-Box which provides accurate alignment of shift arms as it "multiplies" leverage for easier shifting of gears.

Special "Safety-Pin"—Spring loaded pin mates with relieved-elongated selector slots to provide positive gear selection every time . . . won't let you miss a shift.

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Hardened for Lifetime Service—All critical points are hardened and heat-treated for protection against wear.

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55-61 Std. Tr. 599	1962 Std. Tr. 344	w/o or w/o OD 349
w/o OD 600	w/o OD 345	OLDSMOBILE
1962 Std. Tr. 342	1962 HD. Intr. Tr. 346	49-53 Std. Tr. 597
w/o OD 343	1962 HD. Intr. Tr. 346	PACKARD
CHEVROLET TRUCKS	45-50 1/2 T. 607	38-56 Std. Tr. 601
55-61 Pkups 601	PUP 607	w/o or w/o OD 601
CHRYSLER-DE SOTO	MERCURY	PONTIAC
57-61 Std. Tr. 602	40-45 Std. Tr. 604	35-61 Std. Tr. 599
w/o or w/o OD 602	49-51 Std. Tr. w/ 605	w/o OD 600
COMET	Lgr. Circ. Bell 607	55-61 HD. Trans. 601
60-61 Std. Tr. 603	Hug., w/o or w/o OD 607	9-bolt side cover 601
DODGE-PLYMOUTH	51-61 Std. Tr. w/o 605	RAMBLER-NASH
57-61 Std. Tr. 602	OD, exc. '51 606	55-61 Std. Tr. 601
w/o or w/o OD 602	w Lge. Circ. Bell Hug. 605	w/o or w/o OD 601
FALCON	51-61 Std. Tr. 606	1962 Std. Tr. 350
60-61 Std. Tr. 608	57-61 HD. Trans. 607	w/o or w/o OD 350
FORD PASS. CARS	w/o or w/o OD 607	STUDEBAKER
40-48 Std. Tr. 604		49-53 Std. Tr. 609
49-61 Std. Tr. 605		1962 Std. Tr. 355
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FOR ALL CARS NOT LISTED ABOVE—Universal model adapts to almost every 2-lever standard transmission with or without Overdrive. Shift Conversion Kit comes ready to install. In some cases, a small amount of alteration (drilling or filing) on mounting bracket may be necessary. No. 601—Per Kit \$19.95

THESE ACCESSORIES ARE SHIPPED POSTPAID

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Triple chrome plated solid steel with threaded ends. 1 1/2" diam., 12" long. Include hex nut and lock washer. For above kit. Specify straight or curved. No. 610 Each \$2.75	Solid bakelite—full 1 1/2" diameter. Beautifully polished. Drilled and threaded. Universal adapter fits all shift levers. Specify Red or Black. No. 611—Each \$1.00	With large dome and built-in flange for weather-tight seal. Flexible bellows fits all floorboards. Specify oval or round type. No. 612—Ea \$2.00

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Each unit is custom built for perfect fit and is fully guaranteed against defects in workmanship or materials.

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This new Straight Speed Shift can be easily installed in approximately one hour by anyone. No special tools are required. Complete detailed installation instructions are included. Kit includes everything except shifting lever, knob, and boot. Order them on coupon below. Please state stock number of kit for your car (see table at left). Order now!

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WITH THIS NEW
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IT'S SPRY,
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AND THE PRICE
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FOR ME!

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I'LL LEAVE 'EM IN
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ON ANY ROUGH-
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ACTION THAT
SCAT'S A BEAUT!

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DELUXE **DUO-GLIDE**
FOR OUR NEXT
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MAN WHEN THEY
SAY 'SCAT' THEY
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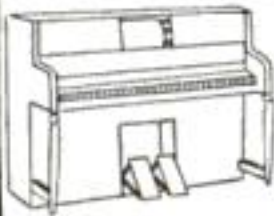
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the engine. It wouldn't run—till we tried rotation in the opposite direction. Then it ran fine, backward! I had slipped up on the camshaft. I made a new one and just got it done in time.

But I had lots of company: In those days, most cars had a chain drive since machine tools were far from what they are today. Few shops were equipped to cut bevel gears. The bevel-gear drive came in about 1905 and many designers were caught with red faces—their cars came out with the bevel pinion on the wrong side of the ring gear. When that happened they had a car with several speeds for reverse and only a low-speed forward.

JOS. SCHAEFFERS, New Bern, N. C.

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MAYBE some of your readers would be interested in the Sidewalk Superintend-



ents Club sponsored by the Michigan Consolidated Gas Co., Detroit, while their new building is going up.

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AL KURTH, Detroit.

Memory-Tickler System

I HAVE no involved filing system, but lest I forget too many good things in PS, I have my own way of locating articles in back issues. With a ball-point pen, I mark the page and subject matter of value to me on the edge of the magazine itself. A glance at a stack of marked issues does wonders.

RALPH E. KROGH, Detroit

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The march of science

Time for satellites, TV—and lunch. If you need to tell time to better than one second in 320 years (a surprising number of people do), you can now get a very-low-frequency radio receiver and tune in the Navy's Panama Canal station NBA. NBA's time signals and carrier frequency have been brought to an accuracy of one part in 10,000,000,000. They count time 10 times more precisely than the best scales measure length or weight.

Super-accurate time signals help track satellites, aim missiles, survey for maps, locate earthquakes, prospect for oil. Television engineers will use them—their new precision can keep sync

generators locked in step even though the studios are thousands of miles apart. Then when cameras switch from Hollywood to New York (or soon, Paris), the picture on your home screen won't roll over the way it often does now.

The Navy gets its proud precision from a new system called A.1 (for atomic-time method number one). The master clock is a cesium atom—the vibrations of atoms are the most uniform ticks known, and can be made to control electronic circuits. The Navy keeps station NBA on time by comparing its transmis-



This moon camera helps set the atomic clocks.

sion with the cesium clock, and speeding up or slowing down the NBA signals as necessary.

Before the A.1 system could go on the air, the cesium clock had to be set—a complicated business that required three years of cooperative experiments by the British National Physical Laboratory and the U.S. Naval Observatory in Washington. The cesium ticks had to be compared to the fundamental unit of time, the second. It is defined in terms of the earth's rotation around the sun (to mix you up, it is measured by observing the moon and stars). While the U.S. carefully shot astronomical photos, the British counted cesium ticks. They finally agreed that exactly 9,192,631,770 ticks of a cesium atom was the equivalent of one second.

The oddest thing, though, is that all this beautiful scientific machinery doesn't help if you just want to know when to knock off for lunch. Atomic time, with its magnificent one-in-10,000,000,000 accuracy, measures intervals of time. This is what you need to calculate distances and velocities or to specify the pitch of a musical note. But atomic time cannot be converted into "historical" time (such as Central Standard Time), which specifies a particular moment of a particular day of a particular year: lunch time today. The reason is that historical time is not uni-

The march of science continued

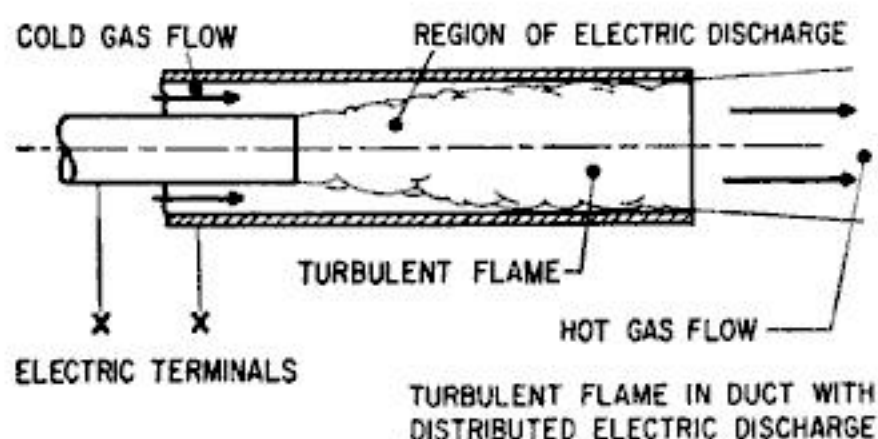
form. It is based on the earth's rotation on its axis (most people prefer lunch at midday). And the earth's rotational speed is distressingly variable. Some seconds of historical time are longer than others; in atomic time, on the other hand, all seconds are identical.

The Navy, as official U.S. timekeeper, also measures historical time (by photographing the position of stars), and tells it by telegraph and radio to anyone who wants to know. The most important users—from the standpoint of lunch eaters—are the electric utilities. They match the speed of their generators to Navy signals, so that a \$2.95 electric clock tells historical time more accurately than a \$295 watch.

Electrified flame. Shoot some electricity into a flame, and you make the fire hotter—a lot hotter. That's what Bela Karlovitz of Pittsburgh's Combustion and Explosives Research figured. Now he and Arthur D. Little Inc. have come up with an electricity-plus-fuel burner that runs up to 6,000 degrees F. (fine for such jobs as

melting tantalum, refining boron, heating organic compounds, and making steel).

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pected to save money on industrial processes that require very hot heat, in large quantities, fast. It is not a gadget for home furnaces (it works on 60-cycle AC, and draws only 12 amperes, but at 2,000 volts).

Down toward the center of the earth. A newly invented dredge has given scientists their first look at the deepest layer of the earth's crust. The dredge fished rocks up from the wall of the Puerto Rico Trench, a four-mile deep chasm in the Atlantic Ocean. The Trench apparently exposes a rock layer just above the Moho, the region where the earth changes abruptly from crust to interior structure.

The dredge, invented by Andrew J. Nalwalk of the Woods Hole Oceanographic Institution, was ingeniously designed to flip clear of big boulders while scooping smaller rocks into a steel mesh bag. It was kept at just the right depth by a "pinger," a small sound-making gadget clamped to the cable 300 feet above the dredge. Listening devices on the ship revealed the pinger's height above sea bottom by comparing the sound waves received directly from it with those bounced back off the bottom of the ocean.

The rocks? They were a type called ultra basic: rough, sharp-edged, light green except where sea water had turned them rusty black.

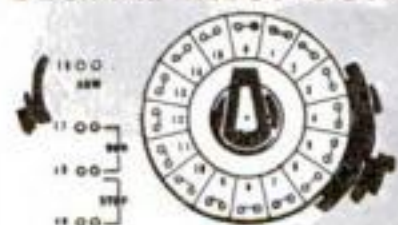
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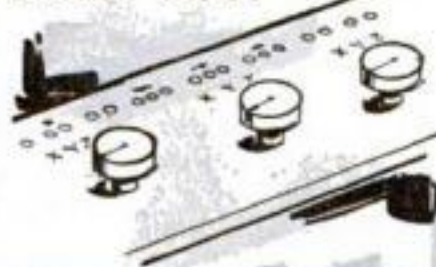
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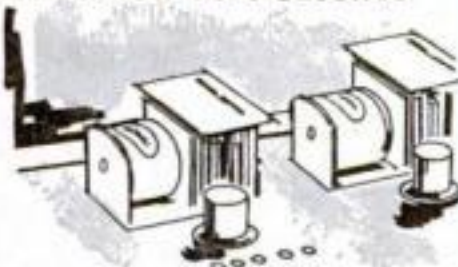
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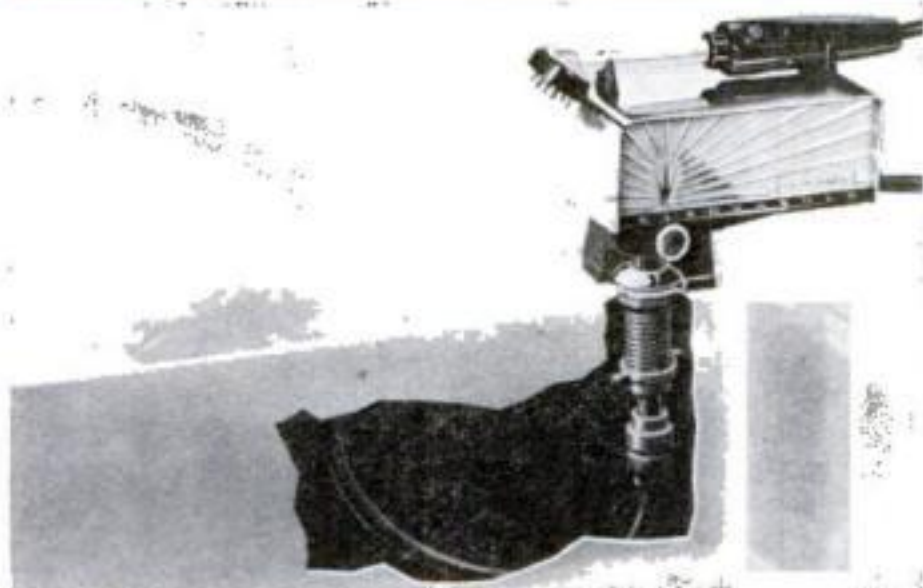
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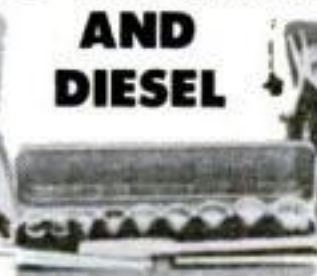
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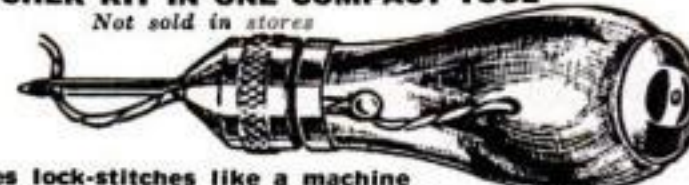
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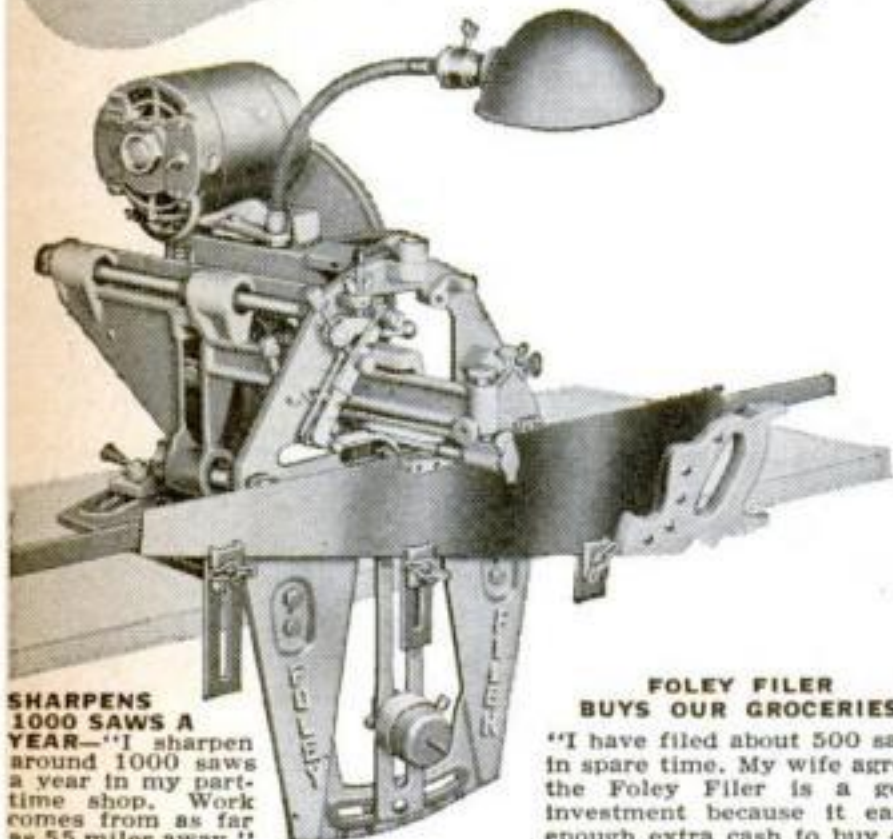
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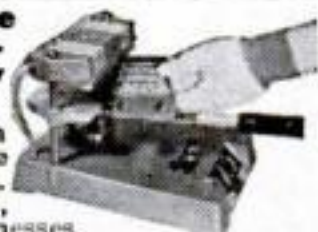
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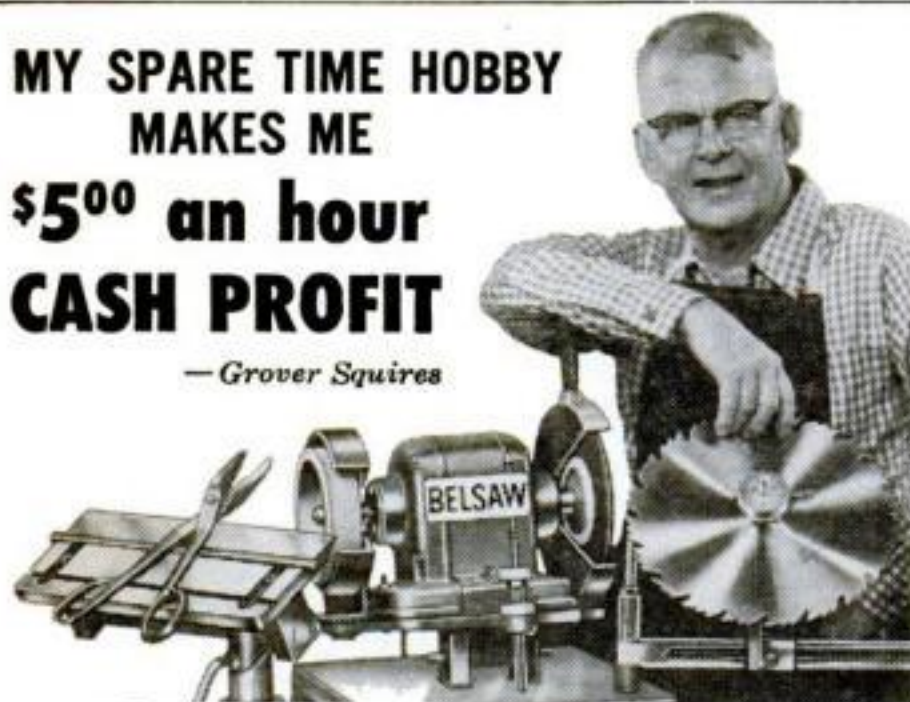


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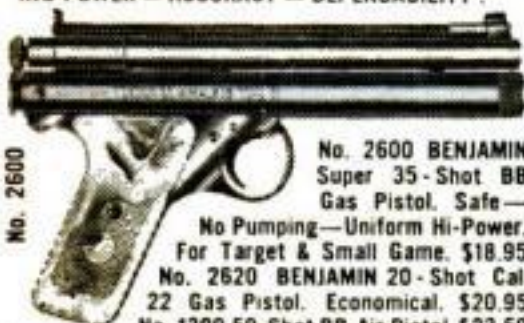


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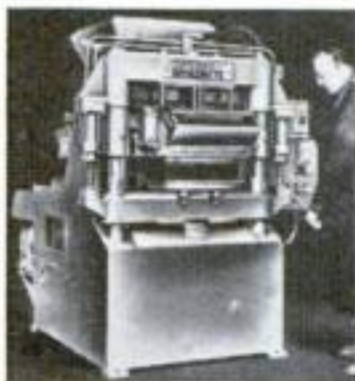
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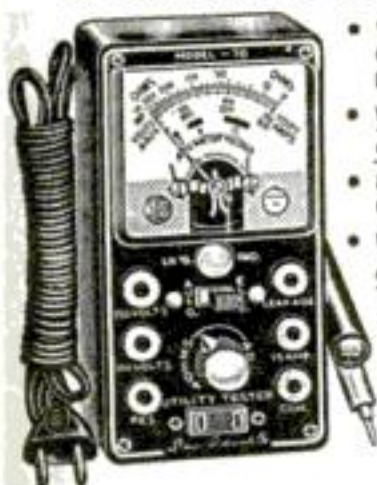
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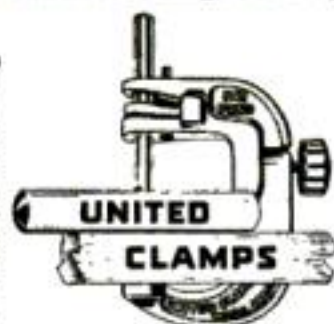
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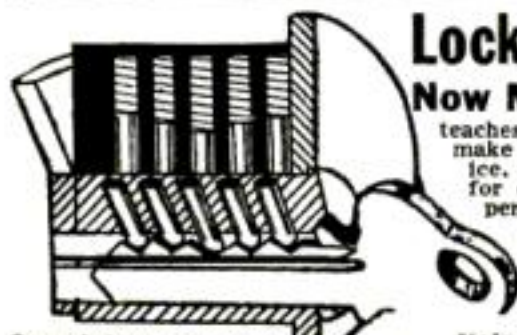


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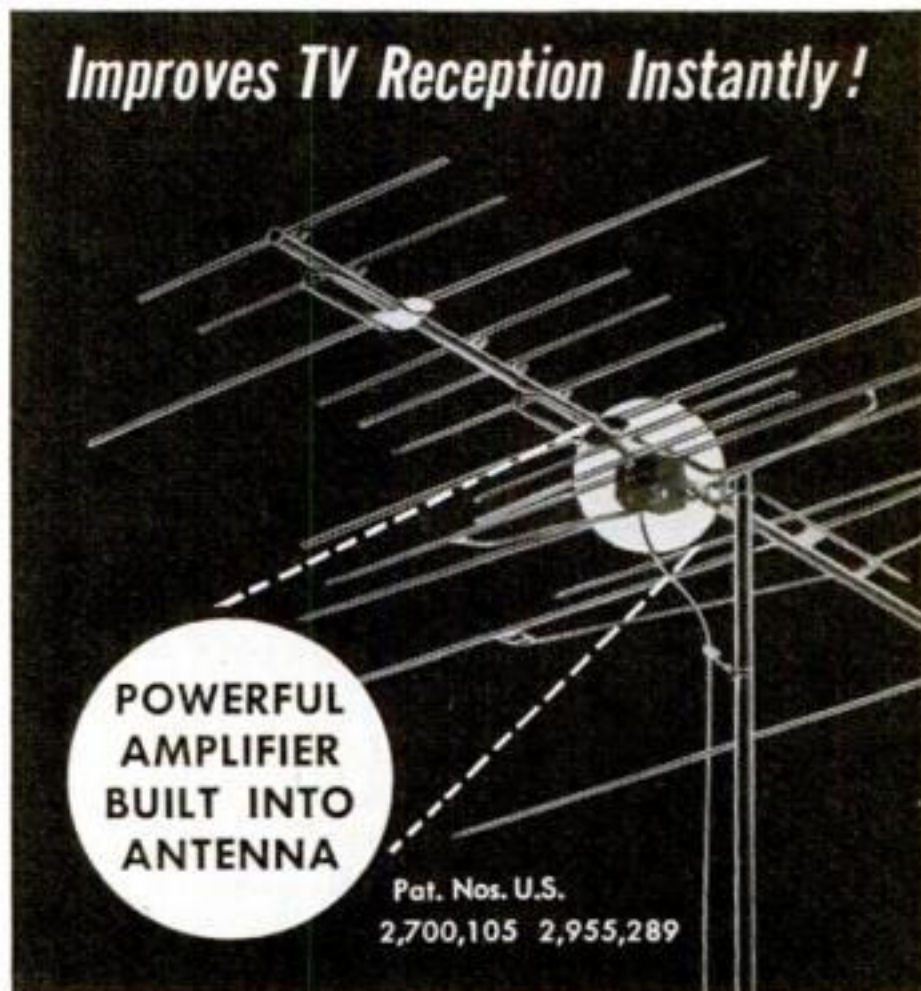
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DETROIT REPORT

By Devon Francis

Self-Starting Car for B-r-r-r Weather

THE day of auto gadgets hasn't flown with the coming of simpler, smaller vehicles. One Detroit manufacturer has developed a self-starting car for the coming winter days. At its heart is a timer—the same thing that turns on a radio automatically, controls the cycles

in your washing machine, or turns off the heat on the roast in the oven.

Want to leave the house in your car at 7:45 in the morning? Set the timer for 7:35. It will switch on the ignition, turn over the starting motor, and warm up the engine for you. Leave the heating system controls in the "on" position the night before—and *presto!* A warm, cozy car is waiting. An automatic choke, of course, is vital.

One question remains unanswered: how to vent exhaust fumes out of the closed garage without having to hook up a flexible hose to the tailpipe.

The manufacturer still hasn't decided whether to market the gadget now or later. It would be an extra-cost option.

Automatic box for midgets. Of all the features on U. S. cars that foreign-car makers covet, the automatic drive rates the highest. Many a potential customer is scared out of a foreign-car showroom when his wife exclaims in dismay, "It's cute, but do I have to shift gears?"

Thornton Products Co. of Dearborn, Mich., has the patent rights to a new kind of automatic transmission that is said to be particularly adaptable to cars of less than compact size. That's because

the transmission is only three-fifths as big and heavy as a conventional torque converter or Hydra-Matic. Moreover, it supplies infinitely variable gear ratios, resulting in a silk-smooth power flow. In that respect it compares with Buick's Dynaflo, though it gives better fuel economy. Its greater efficiency makes it practical for low-powered engines.

As durability testing nears completion, many foreign manufacturers are sniffing expectantly at Thornton's doors.

All for \$1,000? Speaking of imports, watch for the possible introduction of a spectacularly low-priced car from Japan. Already reaching into the U. S. pocket-book with their fine cameras, the Japanese have an eye on the market here for a car with the general characteristics and looks of the Karmann-Ghia Volkswagen—but

with a retail price of about \$1,000. That would be considerably less than half the price of the Karmann-Ghia. The car in question sells in Japan for \$790. The manufacturer figures he could get it across the Pacific and pay the duty with \$200 or so. Could be bad news for other imported mini-cars and Detroit compacts.

Rubber gas tanks. Some Detroit manufacturers are seriously studying airline experience with flexible fuel tanks as a means of reducing the hazards of fuel fires in auto collisions. Fuel-tank and fuel-line ruptures, with resulting violent fires, are not as rare as you may think.

Chevrolet, among others, has artificial-rubber tanks in prototype. As unlike conventional tanks as black is from white, they consist of tubes four to five inches in diameter and seven to nine feet long. Two of these are snaked into a car's rigid steel frame. A single filler neck serves

both big tubes. Flexible hoses connect the tubes to the carburetor. A unitized body would be no problem; a protective metal sheathing for the tubes could be incorporated into the design.

Flexible tanks would have side advantages. Trunk space, now sacrificed in part to fuel storage, would be increased. Vapor lock, occurring in the hot metal tubing leading from tank to engine, would be eliminated. Some of the disadvantages: The flexible tanks are tougher to service and replace, and hooking up an accurate fuel gauge is nearly impossible.



1962 FORD FALCON



1962 FORD GALAXIE



1962 FORD THUNDERBIRD



1962 MERCURY COMET



1962 MERCURY MONTEREY



1962 LINCOLN
CONTINENTAL

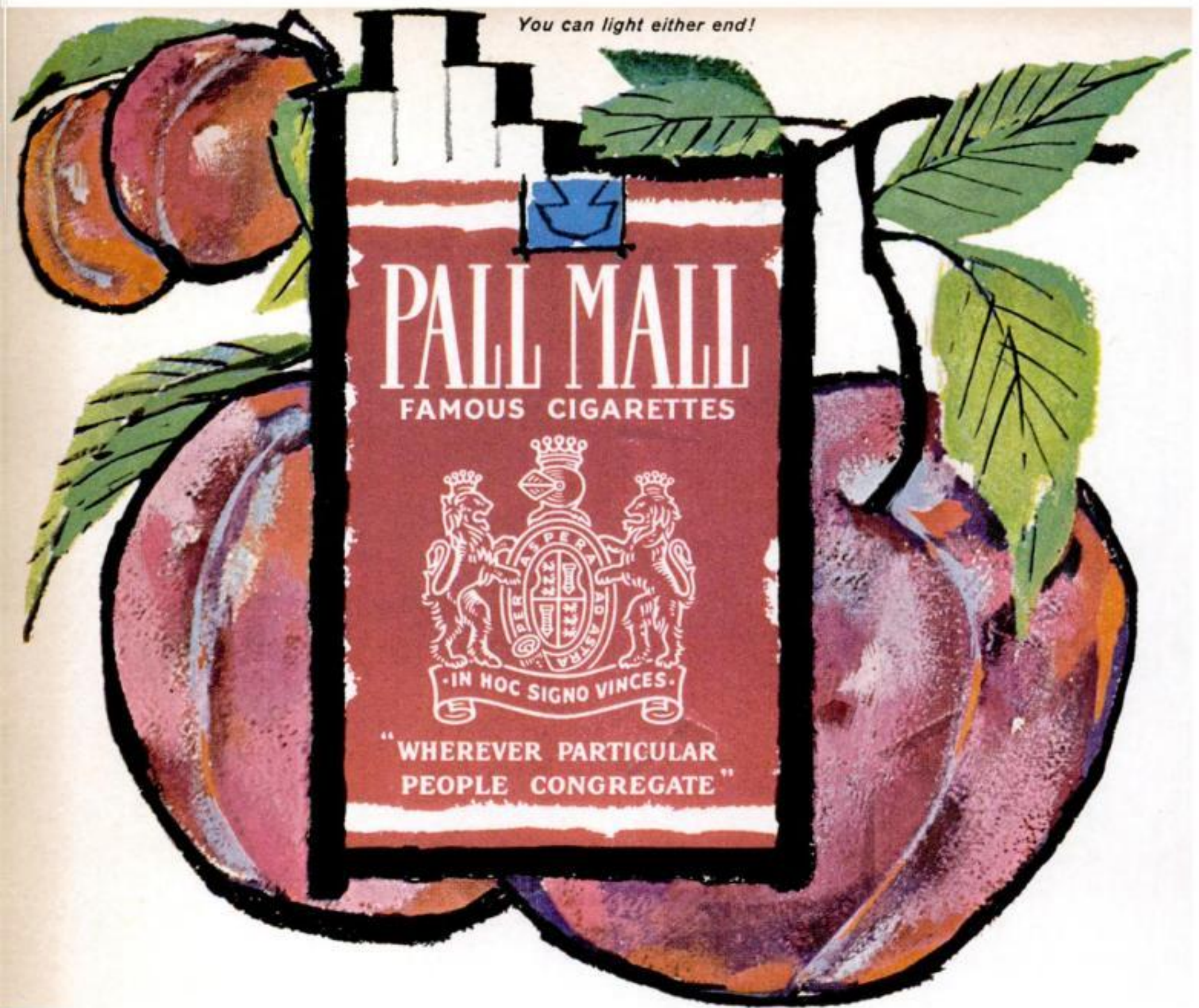
!NEWS! FORD MOTOR COMPANY SWITCHES TO AUTOLITE

Autolite spark plugs are now specified by Ford Motor Company engineers as original equipment on every Ford Falcon, Ford Galaxie, Ford Thunderbird, Mercury Comet, Mercury Monterey and Lincoln Continental they build. One reason why? Autolite Power Tip spark plugs actually clean themselves while you drive. They burn away fouling deposits to keep your engine's power and economy at their peak. No matter what make of car you drive, be sure you always replace with **AUTOLITE SPARK PLUGS**

Clean themselves while you drive



You can light either end!



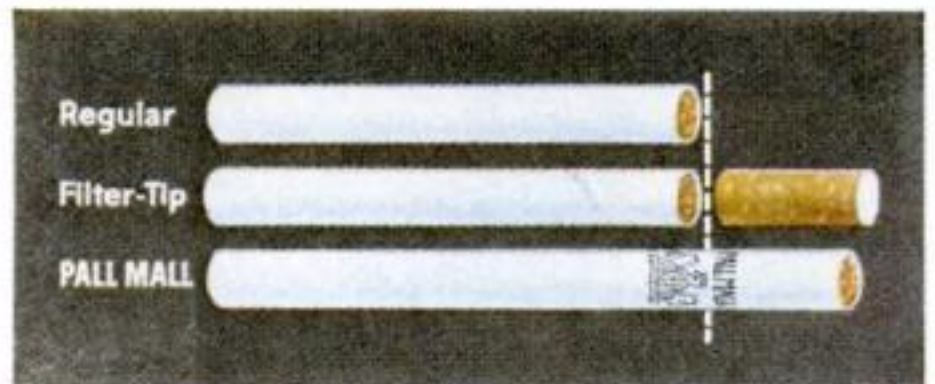
Pall Mall's natural mildness is so good to your taste!

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More 1962s:
.....



Ford's New In-Between Car

By Devon Francis

ONE of Detroit's worst-kept secrets, that new Ford automobile, finally came out into the open last month. Named the Fairlane, this car was a number of things, and there were a number of things it was not.

It was:

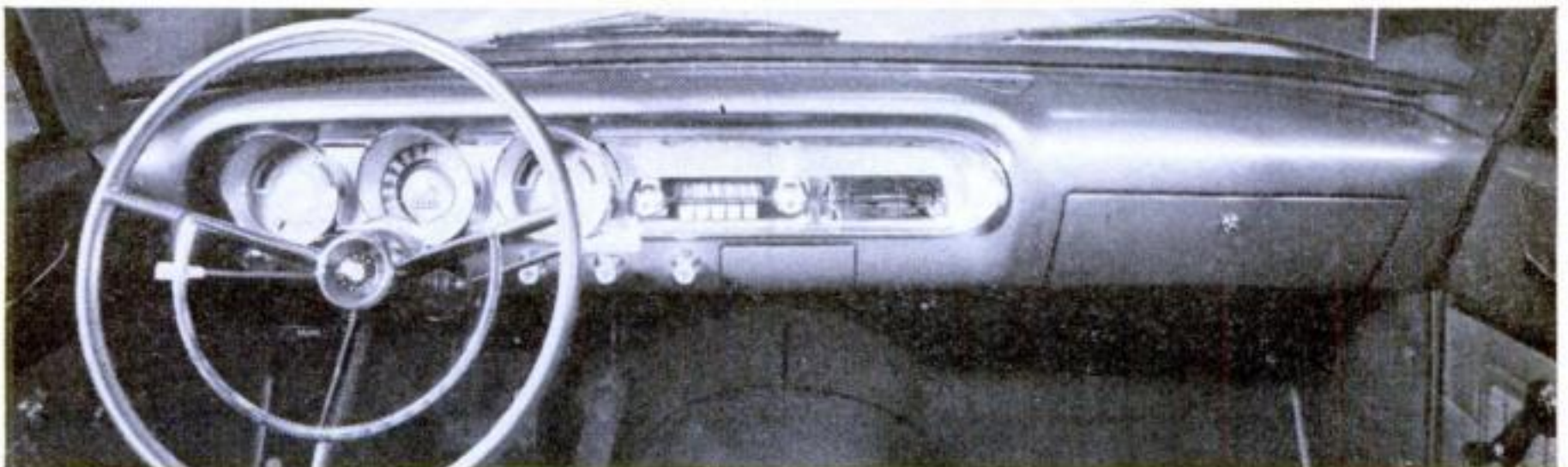
- A middle-size vehicle, with exterior

dimensions about those of the 1949 Ford but with the interior room of the '59 Ford.

- A relatively light vehicle, 900-odd pounds lighter than the standard-size Ford.

- A modestly powered one, with a top optional horsepower of 145.

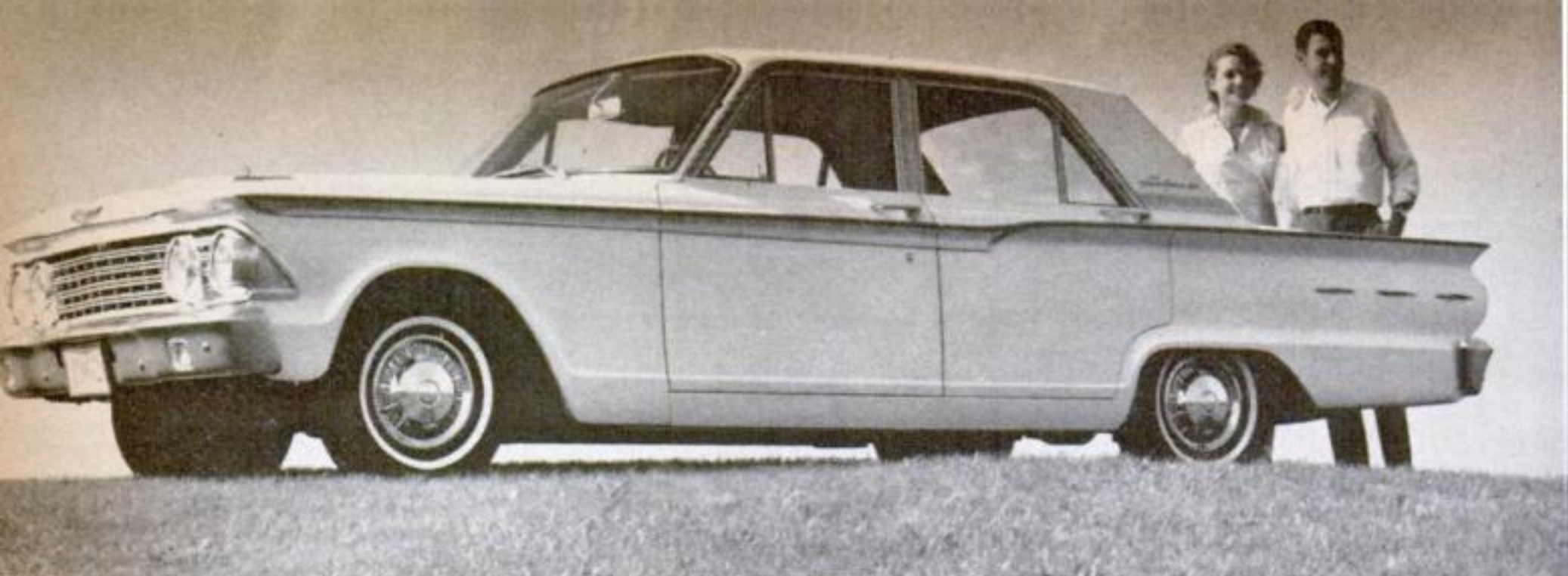
- A medium-priced one as compared with the compacts and full-scale cars.



Dash is flossier than that in most compacts—and ashtray is big enough to hold a man's pipe.

CONTINUED

61



Of "intermediate" size, new Fairlane fills hole left when regular Ford outgrew its britches.

The Fairlane was not:

- Much like the Chevy II, General Motors' new car for the new model year.

- Any more of a departure from completely conventional design than the Chevy II.

- Much of a performer with its standard six-cylinder engine—nor was it intended as such.

- Much of a gas-saver when equipped with a new, small, optional V-8 engine.

The Fairlane and Chevy II have little in common. Reason: The latter was created as an answer to Ford's Falcon—far and away the biggest-selling compact—and the former appears to have come strictly from a designer's nostalgic doodling.

To put the Fairlane in focus, here are some comparisons:

	Wheelbase (inches)	Length (inches)	Hp.	Weight (pounds)
Fairlane	115.5	197	101	2,844
Chevy II	110	183	120	2,545
Falcon	109.5	181.1	85	2,350
Standard Ford	119	209.3	138	3,756
Standard Chevy	119	209.6	135	3,630

(Weights given are for four-door sedans, horsepower for six-cylinder engines. In the Chevy II, a 90-hp. four-cylinder engine is standard, the six optional.)

The new Fairlane—new because the same name meant the top-drawer Ford line of cars only three years ago—is, in



1949 FORD, almost exactly same size as Fairlane, was more than 300 pounds heavier.

truth, like a pristine-white pup in a litter of beagles. It's too long to be a compact car even in the loosest sense of that abused word, and it's too short to keep steady company with today's outsize Chevy and Ford.

In weight, the Fairlane is less of an oddity. It matches up fairly well with the Pontiac Tempest, Rambler Classic, and—another newcomer, to be announced this month—a car called the Mercury Meteor. In weight, in fact, the Fairlane is something of an accomplishment. With merciless scalpel, the designers trimmed fat from it until it is 300 pounds, and more, lighter than the 1949 Ford.

A car for a deacon? Oddball in the litter or no, the Fairlane is no accident. Ford got what it wanted—a car of modest performance, of rather capacious interior, of demure styling and, amid the current friskiness of most cars above the compact class, of a general character befitting a church deacon.

To copper all its bets, Ford designed an optional cast-iron V-8 for the Fairlane. It's small, displacing only 221 cu. in. The next smallest V-8 in the company stable is the 292-cu.-in. engine used in the standard Ford and Mercury. The Fairlane's V-8 produces .65 hp. per cubic inch as against the 292 engine's .58.

The Fairlane's V-8 has another distinction. Including electrical system, it weighs 465 pounds compared with 611 for the 292. It's the nature of the gasoline engine that, as its size goes down, its weight per cubic inch of displacement goes up. With a new process of making thin-walled blocks, Ford has managed to hold the engine to a whisker more than two pounds per inch.

The thin-walled block is Ford's answer to the somewhat tentative use of aluminum blocks by some of its competitors. What the company's engineers and foundrymen have done is improve mold accuracy. They have cut out the excess metal that was used heretofore to compensate for mold variations. The excess had been insurance against thin spots. Plastic sand binders play a part in the new process.

In performance, the Fairlane is completely in character. With an automatic transmission and 300 pounds aboard, it accelerates like this (figures show seconds):

	Six	V-8
0-30 m.p.h.	6.9	5.5
0-60	21.8	15.4
30-60	15.1	9.9
50-80	43.5	20.6

With the six-cylinder engine, the car will consume around 19.5 miles per gallon in average driving. This compares with a bit more than 22 for the Falcon. The V-8 will deliver about 17.

Using Detroit's rule-of-thumb method of estimating prices—\$1 per pound of car—the Fairlane should sell at substantially more than the Falcon, at substantially less than the standard Ford. (Prices had not been announced as this issue of POPULAR SCIENCE went to press.)

And "Canadian Y." A companion to the new Fairlane will be the Mercury Meteor. (For long months Fairlane was known by the code name of Canadian X; Meteor, Canadian Y.) The Meteor will be in the familiar Ford-Mercury pattern—a little bigger than the Fairlane, a little flossier, but with identical engine options and many of the same body components.

The Meteor will have a 116.5-inch wheelbase and measure 203.8 inches overall. That's about the size of the 1952 standard Mercury.

In explaining the thinking behind the Meteor, Ben Mills, Lincoln-Mercury's general manager, explained the reason for the Fairlane as well: "Many people who are moving into the small-car market do not want to sacrifice big-car comfort and convenience. Moreover, some people who have tried foreign or compact cars now want something bigger and better, although not a big car."

That, in an auto lexicon that today is changing meaning every hour on the hour, evidently boils down to a middle-weight. ■ ■

Fairlane four-door sedan

General dimensions: overall length 197; wheelbase 115.5; height 55.5; width 71.3; curb weight 2,844 lb.

Interior dimensions	Front	Rear
Effective headroom	39 in.	38 in.
Leg room	46.7 in.	41.4 in.
Hip room	58.6 in.	58.6 in.
Shoulder room	56.7 in.	57 in.
Cushion height	10.5 in.	14 in.
Cushion depth	19.2 in.	18.2 in.

Entrance room	Front	Rear
Door width	41.1 in.	36.1 in.
Door-opening height	37.7 in.	37.4 in.

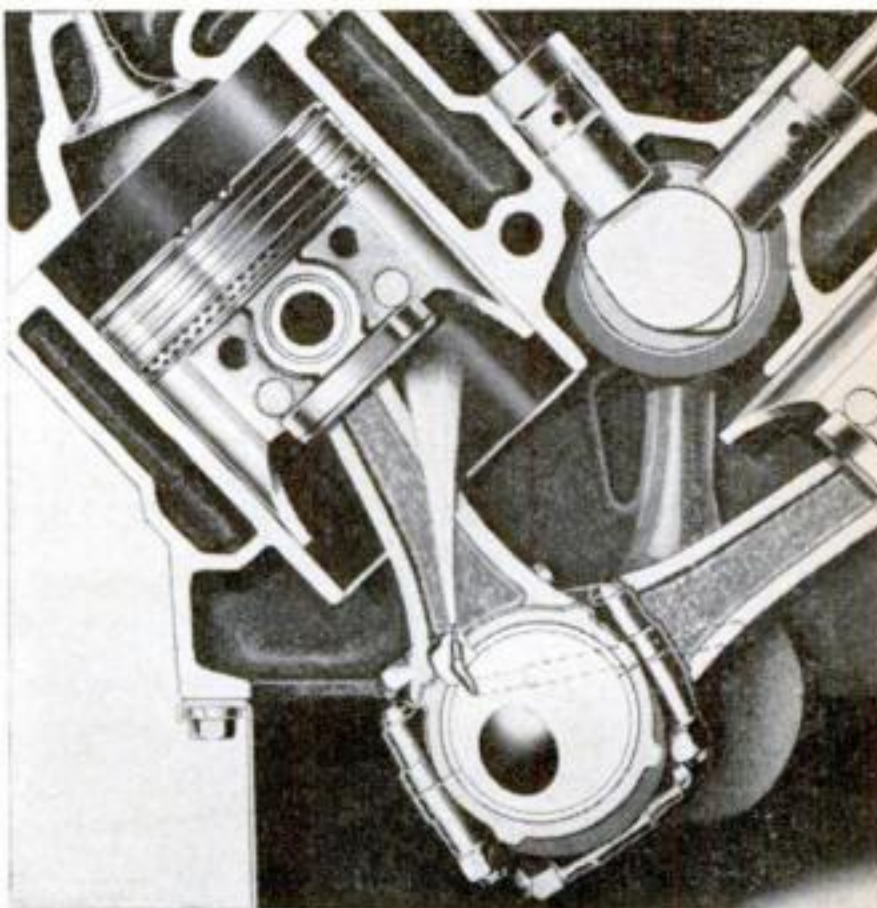
Luggage compartment: length 57 in.; width 69; height 19.3; volume (with spare wheel) 29 cu. ft.

Chassis: brake-lining area 165 sq. in.; turning diameter 39.5 ft.; overall steering ratio 27.6:1; tire size 6.5 x 13 (V-8, 7 x 13).

Engine	Six	V-8
Displacement	170 cu. in.	221 cu. in.
Compression ratio	8.7 (reg. fuel)	8.7 (reg. fuel)
Bore and stroke	3.5 x 2.94	3.5 x 2.87
Horsepower	101 @ 4,400 r.p.m.	145 @ 4,400 r.p.m.
Torque	156 lb. ft. @ 2,400	216 lb. ft. @ 2,200
Oil cap. less filter	3.5 qt.	4 qt.
Water cap. with heater	9.5 qt.	14.5 qt.
Fuel cap.	16 gal.	16 gal.

Transmission-axle combinations (1):

	Manual	Overdrive	Automatic
6-cyl. engine	3.5	Not offered	3.25
V-8	3.25	3.5	3



THIN-WALLED V-8 has same displacement as Ford 1932 engine, but produces 80 more horsepower. New casting process keeps weight close to that of a comparable aluminum engine.



American Motors restyles the Classic and Ambassador and lengthens their service periods—but the big news for '62 is on the little American

Stick Shift but No Clutch Pedal

AMERICAN Motors sprang an eleventh-hour surprise last month with its biggest news of 1962—a new kind of semiautomatic drive.

For the present, at least, it's available only on Rambler's little American, and it costs about a third what an automatic transmission does.

The E-Stick, as they have dubbed it, has no clutch. Just shift. The operation is as slick as a greased pig. If you roll up to a stop light and forget to take the car out of gear, you won't kill your engine. In gear there's no creep.

This drive is unlike Europe's Ferlec or Saxomat drives. The clutch is far simpler. It has no thrust springs or centrifugal weights. It uses a conventional disk and pressure plate. It's thinner than a standard clutch. The big difference, though, is that the levers employed do

not release the clutch—they engage it. It's all done with engine oil pressure and manifold vacuum.

Rambler did have some other news: The last of its longer cars, the Ambassadors, got bobtailed. Nine inches shorter, they are now the same length as the regular Classic models, 190 inches. Chassis-lubrication intervals on the Classic and Ambassador were boosted to 33,000 miles or three years. All the Ramblers offered an extra-cost radiator coolant good for 24 months or 24,000 miles. All the cars had been run through the styling parlors again.

Rambler's poor-man's semiautomatic drive was produced by the engineering staffs of American Motors and the Borg & Beck Division of the Borg-Warner Corp. To see how it works, look at the accompanying illustrations.



Standard Rambler for '62 is Classic Six while glossier Ambassador has V-8 power.

T-bird becomes a convertible convertible



You can have: a four-place Bird that becomes a two-placer . . .

Ford's snooty Thunderbird convertible comes in a new version for '62. It converts as a convertible should, but it also converts from a four-passenger job into a two-passenger. Just attach a plastic cover that shrouds the rear seat. Headrests

How Rambler's new clutch works

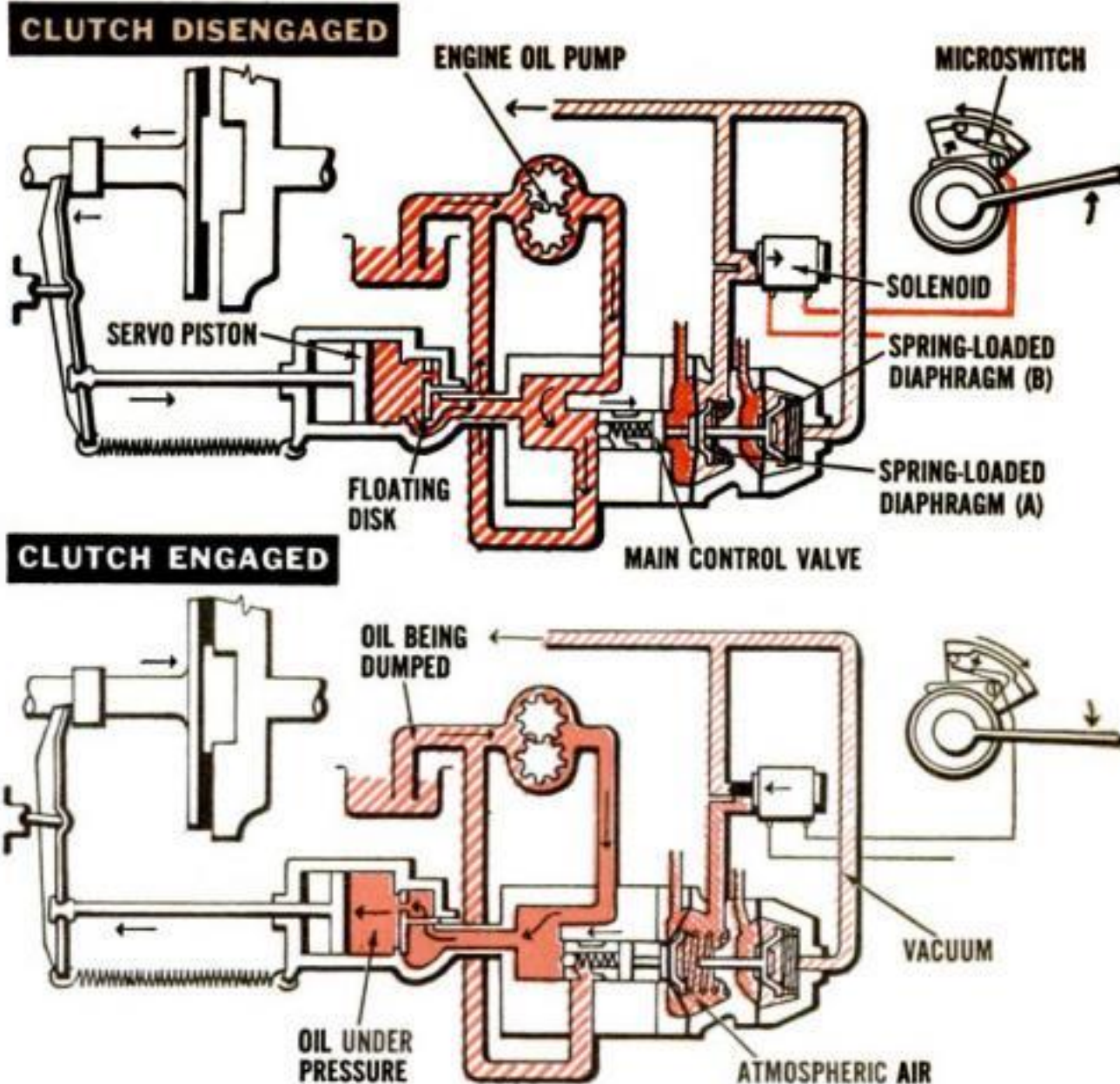
American Motors' automatic clutch is a delectable piece of engineering. Since clutch must engage and disengage quickly and smoothly as driver moves gearshift lever, it requires a sensing element to detect movements of lever, plus "muscle" to move clutch plate back and forth. Sensing element is a microswitch in steering column. "Muscle" is oil pressure from engine-lubrication pump.

Main components of system are microswitch, solenoid, two spring-loaded diaphragms (A and B) that work a main control valve, engine oil pump, a floating disk with an orifice, and a spring-loaded servo piston, connected to clutch yoke.

With engine running and gearshift lever in neutral, the clutch is disengaged. Reason: The microswitch has caused solenoid to open a vacuum line leading from engine manifold to a diaphragm (A). Vacuum overcomes force of diaphragm's compression spring. This opens main valve so that oil behind servo piston is dumped back into engine oil sump. Retraction spring on servo piston at same time keeps clutch disengaged.

When driver wants to get under way, he moves shift lever to low gear. When shift is completed, microswitch causes solenoid to close vacuum line to diaphragm (A). Two forces now begin acting on main valve—pressure of oil from pump on one side, and spring pressure at diaphragm (A) on other side. At engine idling speed, these pressures balance out so that just enough oil is dumped and enough fed behind servo piston to move clutch to imminent engagement.

As accelerator speeds up engine—and oil pump—oil pressure grows. Initial engagement movements of servo are rapid because



of generous oil ports, but final engagement is checked by floating disk. Disk and orifice slow down rate of servo's pressure on clutch yoke for smooth engagement, much as a hydraulic door stop checks closing of a door.

One other piece of control machinery is needed—something to increase pressure of clutch plate and eliminate clutch slip as engine torque builds up. This is done with a second vacuum-line leading from engine manifold to second spring-loaded diaphragm (B). This diaphragm "reads" amount of engine vacuum, which means torque output of engine. At high vacuum—low torque output in a condition of no throttle or light throttle—compression spring in second diaphragm is inoperative. As engine speeds up and vacuum goes down, second diaphragm spring adds its push to main valve, closing off escape of oil to sump, increasing oil pressure on servo piston, and completing firm clutch engagement.

carry the flavor of road racing. The wire wheels have simulated knockoff, racing-type caps.

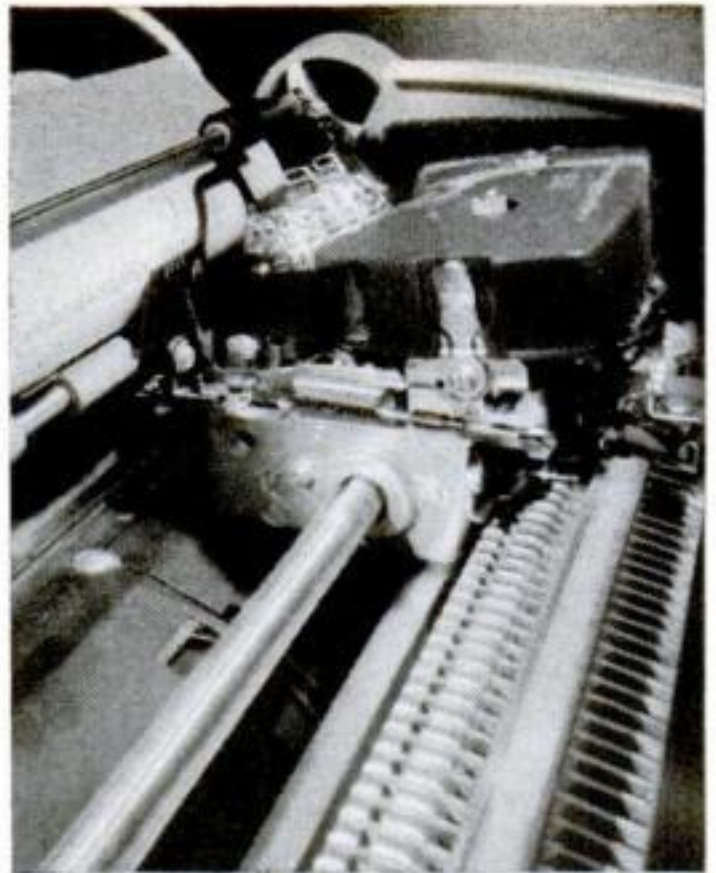
The standard Bird hardtop has a vinyl-on-steel roof with a landau ornament that's strictly for appearance. The 300-hp. engine and other mechanical innards are substantially unchanged.



... or a Bird with four places and a simulated landau top.



NEW IBM TYPEWRITER looks like any other except for lack of movable carriage. Five of its interchangeable type-face spheres are in foreground. Sixth is in machine.



TYPE BALL is whirled and tilted by high-speed electric motor, moves one space on bar as each key is struck.

Fixed-carriage typewriter is speediest yet

Remember the old toy typewriters with the dial you twisted around to pick out the letters? The newest electric typewriter works the same way—but so fast that all you see is a spinning blur.

Instead of type bars, IBM's new Selectric prints from a golf-ball-size sphere of type that slides along a shaft in front of the paper-carrying cylinder. The result is a compact typewriter with no moving carriage: When you strike a key the ball flips to the right letter, hits the paper, and then moves over a space. At the end of the line, it slides back to the left.

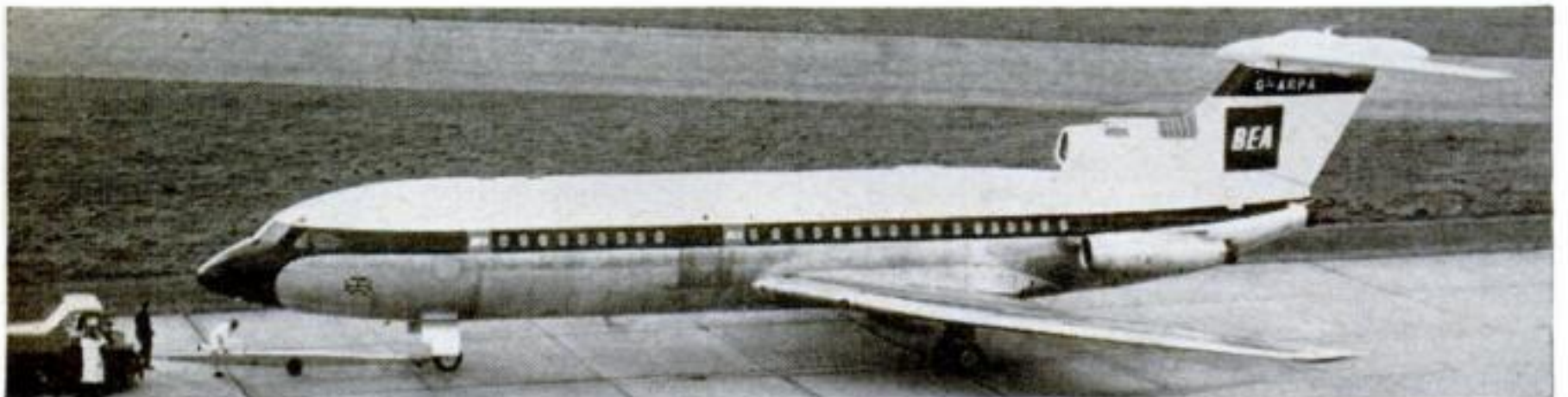
The result is lightning typing—50 per cent faster than on a standard electric, IBM says, because the type doesn't have as far to travel.

You can't jam the keys. If you type

two characters almost simultaneously, the machine types the one you *really* struck first, stores the second one a moment, then types it. This eerie memory depends on a timer that can discriminate between strokes as close as 20 thousandths of a second apart—faster than the most whirlwind secretary can type.

Other niceties: fast and clean ribbon changes (the spools come wrapped in a cartridge), and the ability to change type faces. If you feel like using a script type you can plug in a new sphere. There are six print styles, so far, available for \$15 each.

The typewriter comes in two models: a standard size, to take 11-inch paper, for \$395; another with a 15½-inch-width paper intake for \$445.



Triple-jet airliner

The Trident is rolled out here at the de Havilland plant in Hatfield, England. It's the first of the three-jet transports planned for short-to-medium-range flights

by a number of builders, among them Boeing and Vickers [PS, Feb. '61]. The Trident mounts three Rolls-Royce Spey turbojets in its tail, each with a thrust of 9,850 pounds. British European Airways has placed an order for 24.

How Fire Detectives Track Down ARSON



They're putting the heat on the vicious criminals who set fires for profit with tragic loss of life and property

By Robert A. Kelly

IN the next 30 seconds a major fire will break out somewhere in the United States and, during each half minute that follows, another and another. Shockingly, one out of five will have been deliberately started.

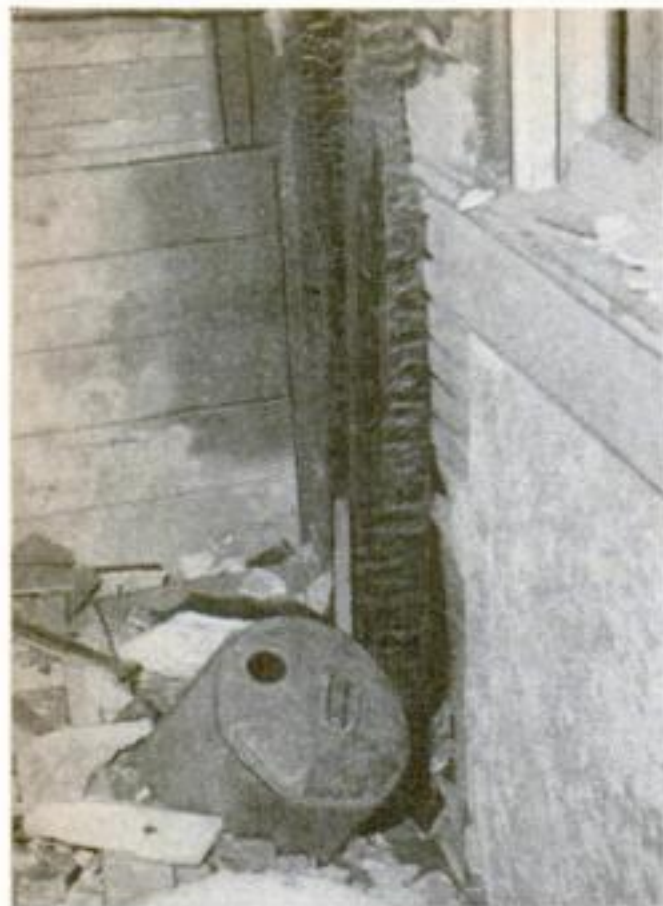
Arson—a constantly growing crime, according to insurance-company and fire-department investigators—cost

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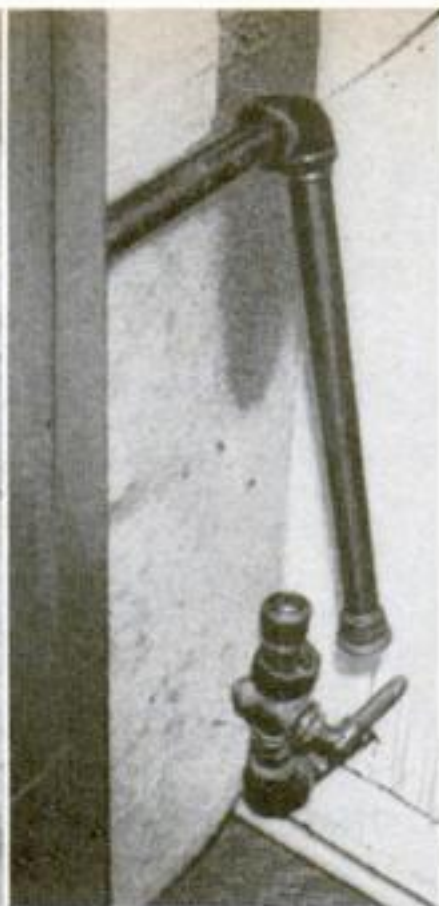
NOTED FIRE DETECTIVE John Kennedy examines a charred structure for clues. In photo below, outline of volatile fluid poured on the floor is immediately obvious. Accelerated by the fluid, the fire burned most fiercely and did the greatest damage in this area.



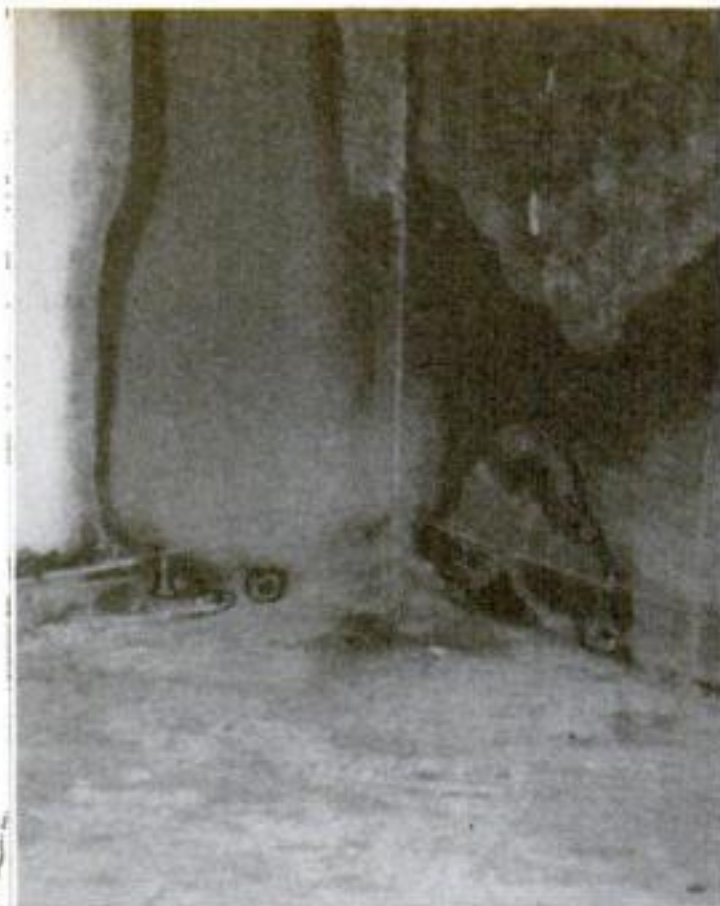
Accident or arson? Expert detective work



CONTAINERS found at the scene of a fire are suspicious. This blackened five-gallon can held a combustible fluid.



DISCONNECTED FUEL LINES are a sure giveaway of arson. This open gas pipe was the cause of an explosion and fire.



TWO SMALL BURNED HOLES can be seen at center of photo. To the right was main fire—proof that multiple fires had been set.

nearly \$400 million in property loss last year, not to mention the tragic loss of life. Profit is the usual motive behind the arsonist's torch.

Our best defense against wholesale arson is the dedicated fire investigator. His tools are experience taken from the ashes of countless fires, an abiding hatred for the arsonist, and a pair of eyes turned to the smallest sign of an incendiary fire.

The slightest clue, invisible to the untrained eye, often changes a routine report of accidental combustion to the vicious crime of arson—a fire willfully and maliciously started—one of the hardest crimes to detect and most difficult to prove.

In court, the investigator is always against the wall. The burden of proof is squarely on him. He must come up with visible proof that the fire was started with intent to wantonly destroy the property.

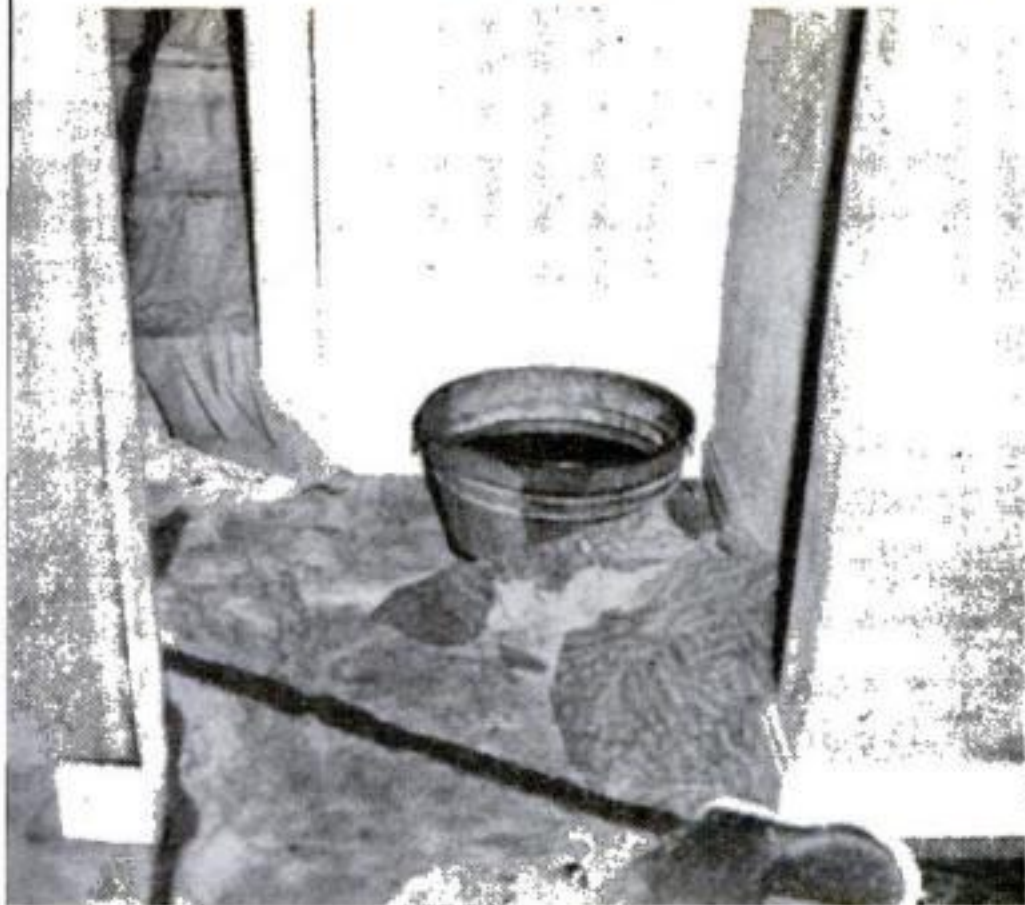
How firebugs are caught. Through the years, he has learned to look for certain clues, some obvious, some well hidden. For example, an investigator is assigned to look into a blaze extinguished only an hour before. He arrives on the scene while the ashes are still warm. Immediately he looks for the obvious: Are containers lying about that might have held a combustible material? Has a trailer—

a ribbon of cloth or paper soaked in a volatile fluid and trailed from room to room—been used? Has the furniture one would expect to see in a room been replaced with wooden boxes and cheap springs? Have fuel lines been unhooked to accelerate the fire? Have the shades been nailed down to keep the neighbors from noticing the fire until it had a good start?

With experience, the fire investigator looks deeper for signs of arson. Often he will smell the pungent odor of ammonia, traditionally used by arsonists to mask the odor of gasoline. Of course, he becomes suspicious. On closer inspection, he notices that several of the under beams have burned down, instead of up, as fires normally burn. Immediately he knows that a volatile liquid had soaked down into the wood, with the result that the fire followed it down.

Once the investigator has cleared the room of debris (after sifting the ashes for clues), he may notice that two or three separate fires had apparently started with no obvious connection between them. Multiple fires such as these are almost always a solid indication of arson, since it is unlikely that more than one fire could start spontaneously at the same time. Multiple fires are an arsonist's insurance against a fire's going out.

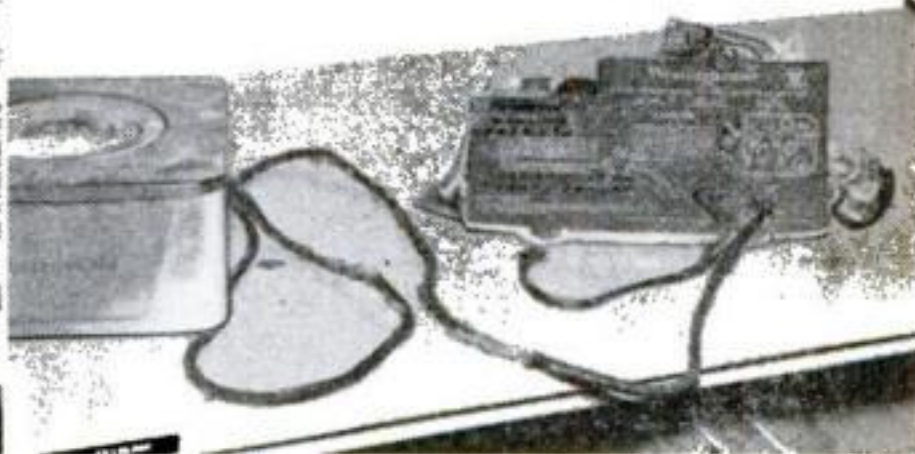
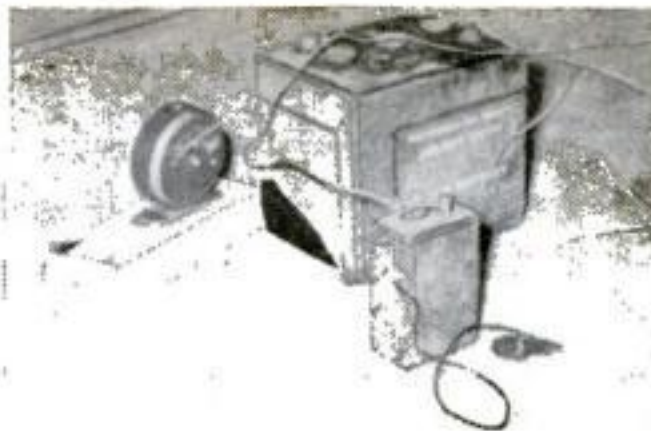
spots telltale clues that point to the firebug



TRAILERS—strips of paper or cloth soaked in combustible fluid and run between rooms—help spread fire. But they also leave carbon trails, as did this toilet-paper trailer.

A favorite trick of the arsonist is the “quick catch.” He punches holes in the plaster so that raw wood is exposed, allowing the fire to spread that much faster.

Fire doors and sprinkler systems are always suspect. An accomplished fire setter usually ties back the fire door or otherwise makes sure it is sufficiently open to provide enough oxygen to sup-

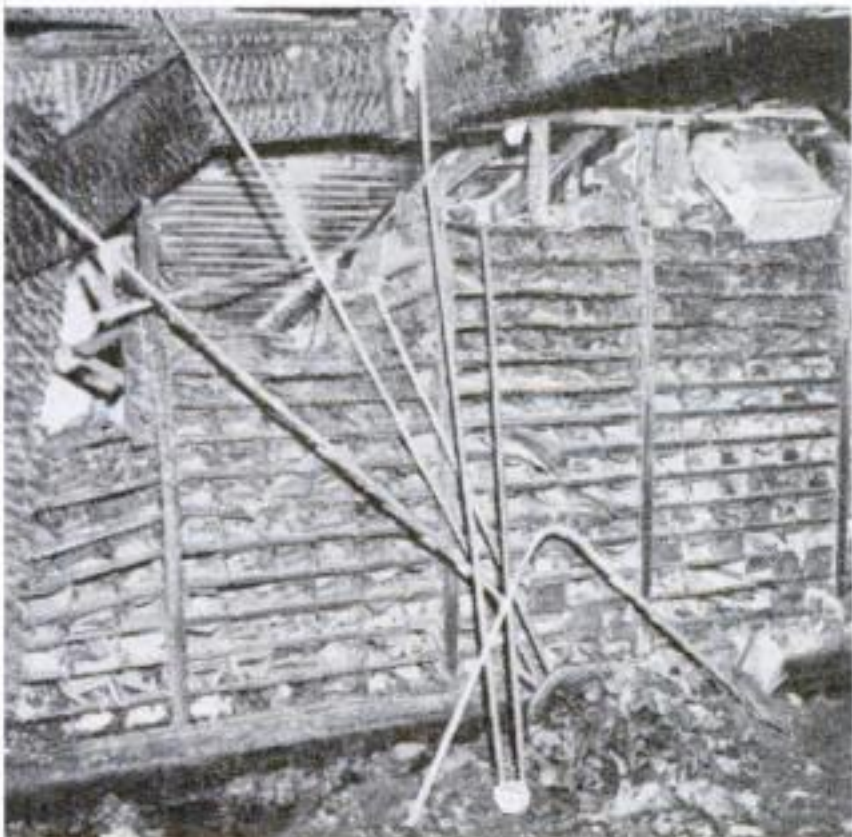


MECHANICAL DEVICES are popular arson tools. Clock radio above triggered an electric hot plate, which fired a stack of papers. Inset shows clock-battery short-circuit mechanism.

port the fire. The sprinklers, too, are usually turned off at the main valve.

Like the regular policeman, the “fire cop” looks for signs of forcible entry. Often this fact, combined with a seemingly innocent item like inoperative sprinklers or fire alarm, is sufficient to convict a suspect of arson.

[Continued on page 220]



INVESTIGATORS looked at this shoe-store fire with a jaundiced eye after they had examined the shelves. Most of the shoes had been removed from the store just before the fire.



TOTAL DESTRUCTION of a car is unlikely except in cases of arson—as with this car, which was almost completely burned out. Glass melts if temperature is raised by a combustible. Insurance companies find that auto-fire claims increase consistently as the economy dips.



TWO-FOOT-LONG "STINGER" projecting from bottom left corner of the clearing blade is

rammed through the heart of larger trees. This is the softening-up phase of the attack.

Tree Stinger Downs Forest Giants

BULLDOZERS equipped with razor-sharp blades and a "stinger" are slicing their way through vast stands of hardwood trees and thick underbrush with the ease of a power mower munching on a suburban lawn. The project: clearing 21,000 densely forested acres of Texas bottom land.

Small trees up to 18 inches in diameter are shaved off with hardly a pause by the 30-ton D8H Cats. Larger ones are "stung," toppled, and their stumps sheared flush in a minute and a half or less.

The operator attacks these forest giants

with the tractor running full tilt, the two-foot-long stinger aimed at the heart of the tree. The stinger rams through the tree and splits it vertically. With the tree weakened, the Cat backs off to withdraw the stinger and bring its scythelike blade into cutting position.

Six of the machines, belonging to the Tarrant County Water Control District, have been at work since January, clearing the site for the forthcoming Cedar Creek reservoir. Each tractor has been clearing an average of 1½ acres, or over 500 trees, per hour.



FOR THE NEXT CHARGE, the Cat backs off, shifts to the left and aims the blade several

feet off the ground to topple the weakened trunk with a severing and pushing action.



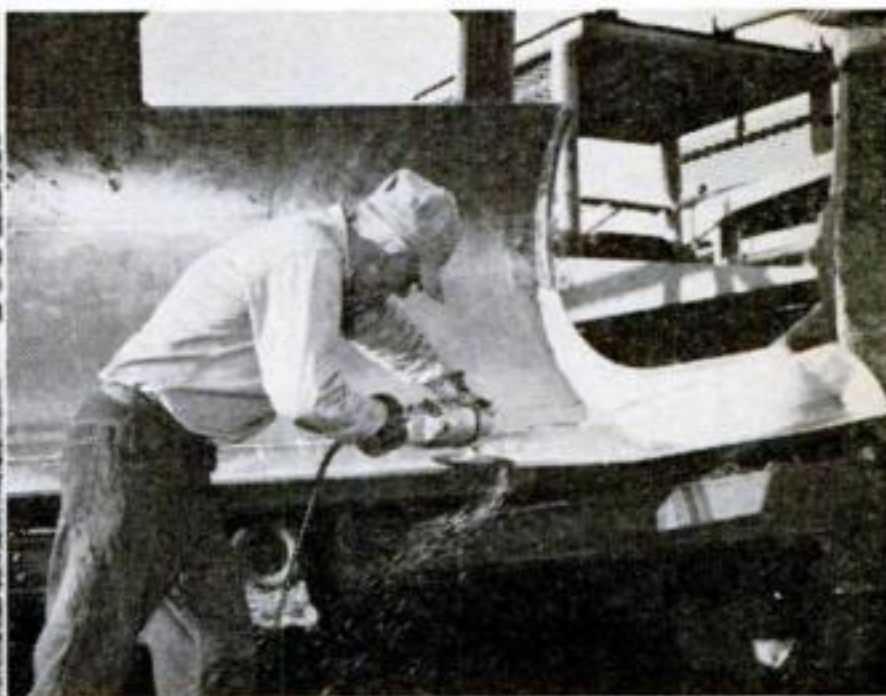
ON THE THIRD PASS, razor-sharp blade is dropped to the ground. Felling the tree has removed the downward pressure of its weight and shattered trunk can be sliced off clean.



TRUNK OF THIS AVERAGE-SIZE OAK, 42 inches in diameter, was sheared off flush with the ground in a single stroke. Close cutting prevents growth of suckers from tree roots.



STRUNG OUT 50 to 100 feet behind one another and spaced a blade's width apart, the six Cat tractors work counterclockwise. Tubular bar over each blade pushes tottering tree.

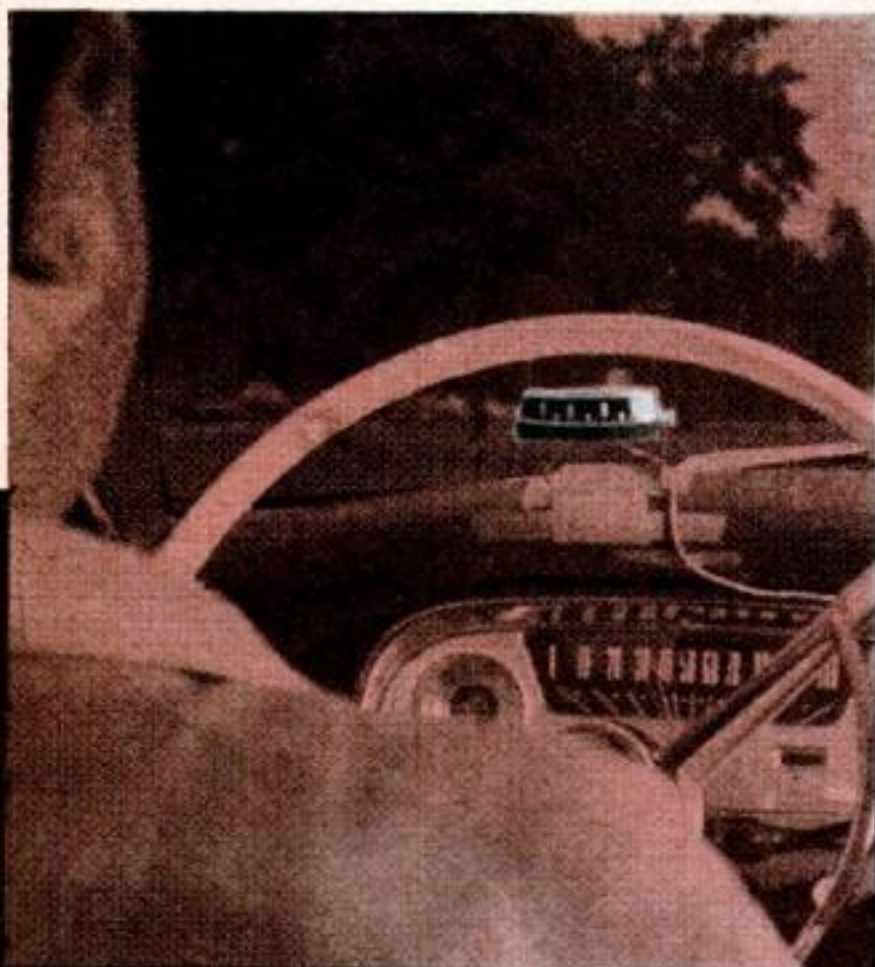


CUTTING EDGES of the 13-foot clearing blades are sharpened every morning before the day's work begins. The blades are mounted at an angle to impart an easy slicing action.

Instant Fuel Meter

Helps You Stretch Gas

By Hubert Lockett



DRIVE MASTER KIT includes everything you need. Fuel block screws into fuel pump or carb in place of regular fuel line and provides connections for sensor and fuel line.



How many miles per gallon are you getting? This dashboard meter tells you at a glance

EVER since we started nourishing our horsepower on gasoline instead of oats, engineers have been busy devising ways to measure how much fuel an engine uses at the instant it uses it. Now there is a new instrument, details of which are revealed here for the first time, that does just that. You can see your miles per gallon continuously.

It's called the Drive Master. It will soon be available from many new-car dealers. Price: about \$60 installed. Or you can order one from the manufacturer (Ongaro Dynamic Industries, Columbus 12, Ohio) and install it yourself. If you're a fair mechanic, it'll take about half an hour.

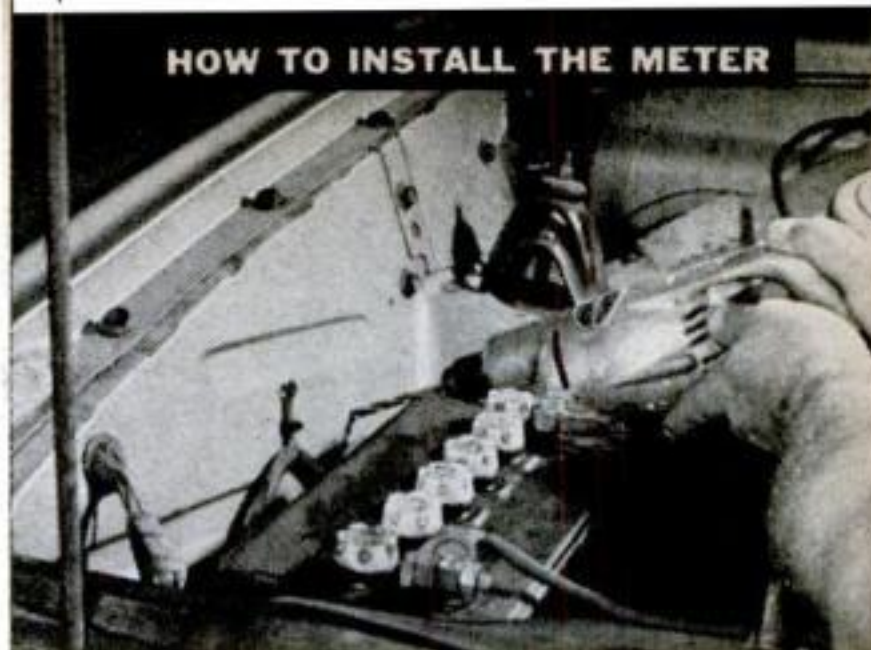
The Drive Master comes complete with a fuel block, fuel line, and fittings needed. The fuel block screws into either the carburetor or the fuel pump to provide connections for inlet and outlet lines to the sensor and for the present fuel line.

Unlike many gadgets that purport to show gas mileage, the Drive Master measures the actual rate of fuel flow to the carburetor. It shows you, on a dash-mounted meter, exactly how much gas you are using at any moment. Every bit of gas leaving the fuel pump flows through a sensor unit installed between fuel pump and carburetor. Without affecting or restricting the flow, it measures rates from 1/5 to 12 gallons per hour.

The sensor translates the rate of flow into an electrical signal that is transmitted to a dashboard instrument marked in gallons per hour. You can find your miles per gallon at any instant simply by dividing the meter reading into the speedometer reading. For example: If the meter reads two g.p.h. when your speedometer reads 40 m.p.h., you are getting 20 m.p.g.

Driving with a fuel meter. In your first few miles behind the wheel with a Drive Master, some of your cherished notions about economical driving techniques may be exploded. Others will be dramatically confirmed, and you'll learn some new ones as the miles pile up.

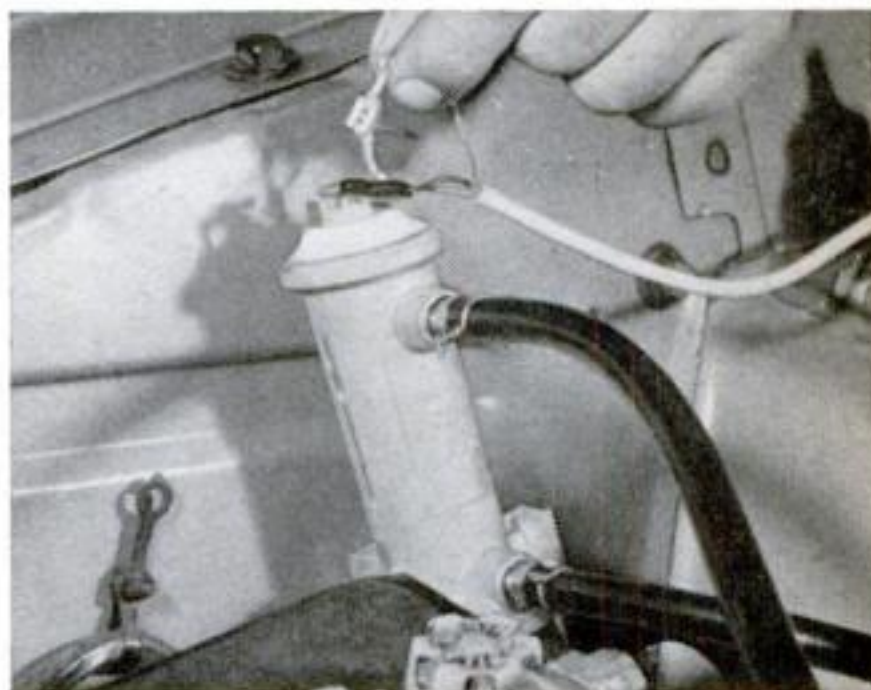
To get firsthand experience with the Drive Master, I tried it on both my cars.



1 LOCATE SENSOR away from direct heat of exhaust, convenient to fuel pump and carb.



2 CHOOSE ONE OF THREE mounting holes in sensor for most convenient mounting position.

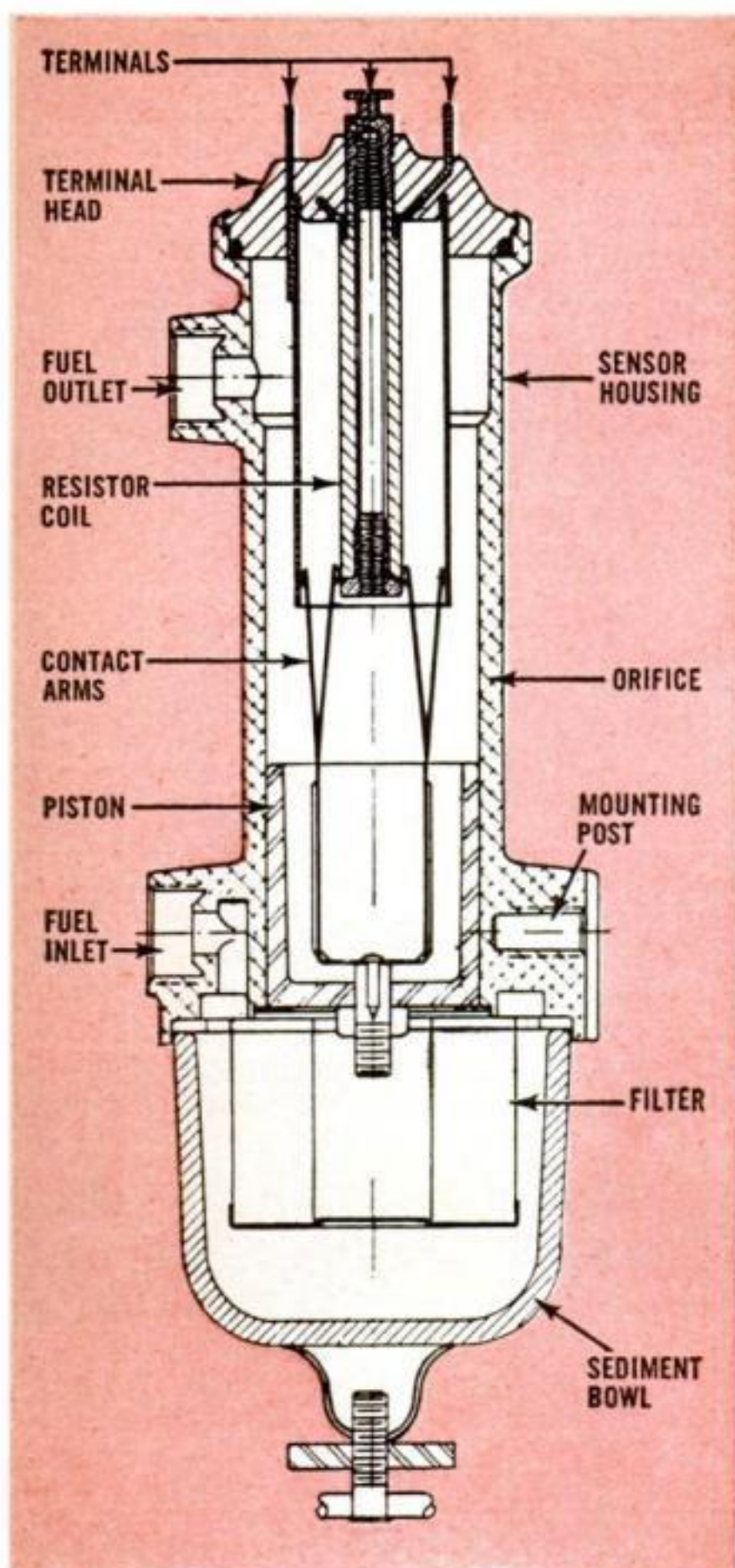


3 MATCH COLORED WIRES in cable to color-coded terminals on top of sensor housing.



4 MAKE ELECTRICAL CONNECTIONS under dash—one to light switch, one to ignition.

CONTINUED



FREE-FLOATING PISTON moves in response to variations in flow rate, changing area of variable orifice. Position of piston is detected electrically, and result appears on meter on dash.

I kept records for some 500 miles, and ended up with these conclusions:

- You don't have to drive at a snail's pace to save gas.
- You needn't become a slave to the meter. Fairly casual attention to its silent coaching pays off.
- Theoretical awareness of the kind of driving that wastes gas is not nearly as effective as the silent reminder given by the meter.
- Some things reputed to be sure-fire gas savers are not necessarily so.

Your first surprise comes before you've

covered the first mile: The rate of fuel consumption varies enormously even during normal driving. Although you know, in theory, that this must be true, it's an eye opener to see the needle indicating anywhere from one to eight g.p.h. before you're out of the 40 m.p.h. speed zone. You begin to realize how little the usual way of measuring gas mileage tells you about your car's operation. The measurement is made *after* the gas is used up. It can only tell you the average consumption over a period of time.

It came as a shock to see that my V-8 could be driven for long stretches at 21 to 22 m.p.g. I've always thought of it as a hopeless gas hog—average mileage has been a little less than 12 m.p.g.

The Drive Master showed me a couple of things about my driving habits and one about the car itself that were pulling my average down. I had an unconscious tendency, I learned, to accelerate slightly going up hills. The difference in speed was almost imperceptible but the cost in wasted gas was significant. When I took a typical hill normally, the needle would swing up to five g.p.h. or more at a nominal 50 m.p.h.—less than 10 miles per gallon. Watching the meter, I could get up the same hill without exceeding 3.5 g.p.h. by allowing my speed to drop only two or three m.p.h. The lost speed could be regained economically on the downgrade so there was little or no loss in overall average speed.

Does the meter pay off? To see if this and a couple of other tricks I learned would really pay off, I made a trip 75 miles from home and returned. Going out, I ignored the Drive Master and drove as usual. Coming back I heeded the meter's advice, but didn't allow it to make me a public nuisance on the highway. The outbound trip took 5.4 gallons, the return used 4.1. The return trip, by stop watch, was only six minutes slower. The improvement from scarcely 14 m.p.g. to better than 18 m.p.g. meant almost a 25-percent saving on the gas bill.

With my compact six, the percentage gain was not as great, but was still worthwhile. Mileage went from 20.5 m.p.g., driving without the meter, to 25 m.p.g. by watching it—an 18-percent improvement.

During a week of running errands

[Continued on page 198]



Rocket for the moon

More than 1,000,000 pounds of thrust streams from the F-1 rocket engine above during a test at Edwards Air Force Base, Calif.

The engine is the free world's most powerful space booster. It has generated up to 1,640,000 pounds of thrust during 19 firings.

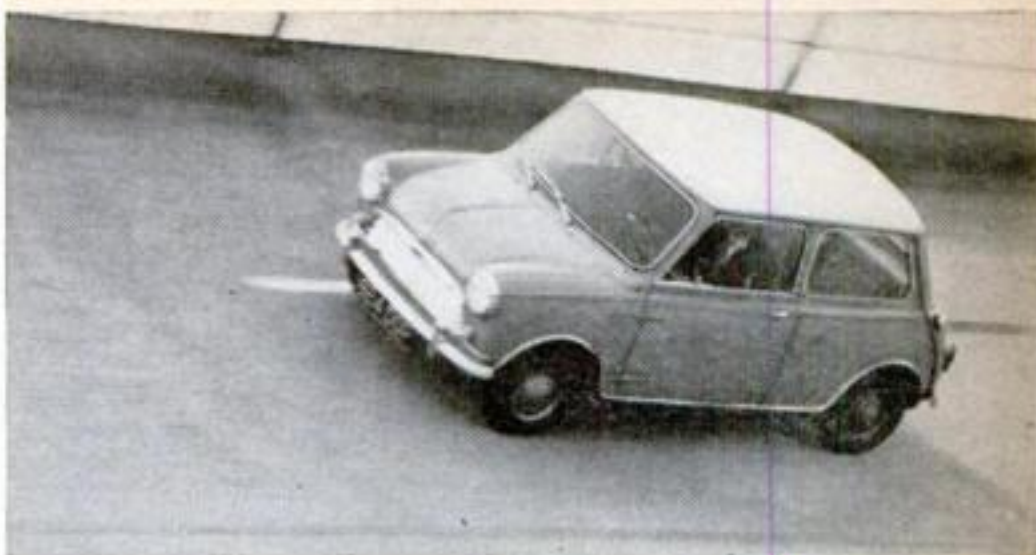
It's being developed by North American Aviation's Rocketdyne division under direction of the National Aeronautics and Space Administration. NASA plans a cluster of eight as the first stage of a manned space craft intended to land an expedition on the moon by 1967.



Hula-hoop boat

A steel ring resembling a hula hoop both propels and steers this unusual boat. As the hoop goes up and down, it pushes a horizontal paddle under the water; as it's moved to right or left, it angles an attached rudder.

The boat was built by two Frenchmen, Georges Breganti (shown at the controls) and Georges Raimondo, and sailed by them late last summer more than 100 miles from Nice to Corsica in 126 hours (more than twice as long as they had expected).



Taking a banked curve at near top speed of 87 m.p.h.

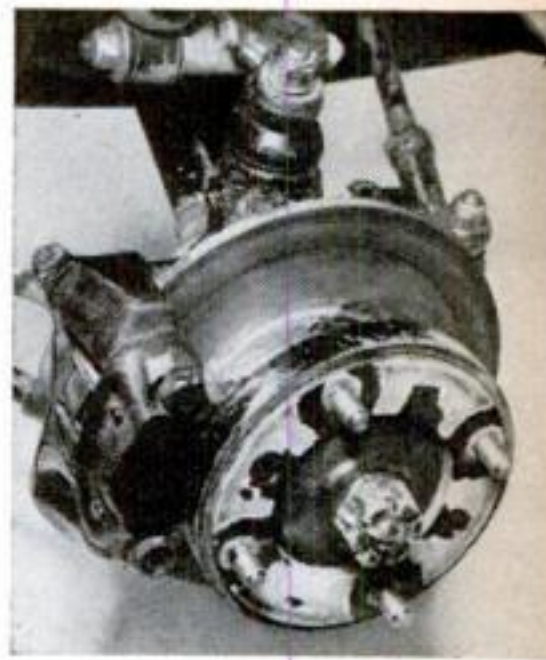
Needled-up British midget

Morris Mini-Cooper, a high-performance edition of the Morris and Austin 850, now has 55 hp., up from the standard 34 hp. Top speed is 87 m.p.h., and acceleration from 0 to 60 m.p.h. takes 18.5 seconds.

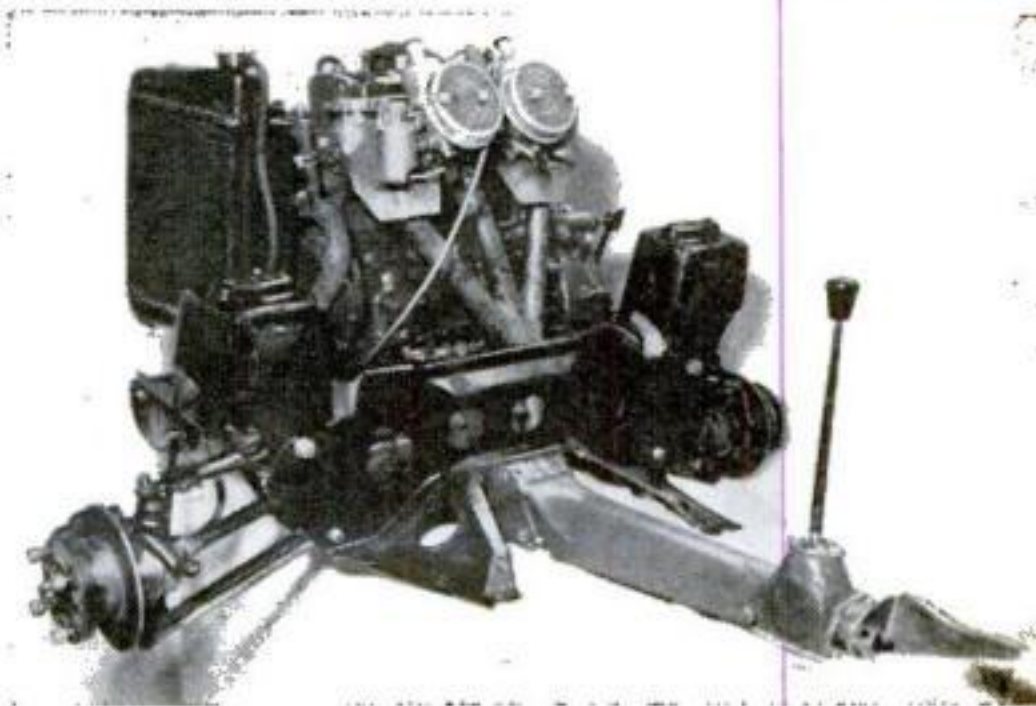
The engine, with capacity increased to 60.85 cu. in. by a longer-throw crankshaft, has twin S.U. carburetors, larger inlet valves, a modified combustion chamber, a free-flow exhaust system, and double valve springs that allow revs to 6,000 r.p.m. Compression is raised to 9:1.

The car has a 16-blade cooling fan, fresh-air heater, sports-type bucket seats, extended instrumentation, and improved interior trim.

DISK BRAKES (right) on front 10-inch wheels are 7-inch units specially developed by Lockheed and the smallest ever put on a production car. They are boosted by a hydraulic intensifier.



GEARBOX of transversely mounted front-drive engine below has a remote shift lever. Long housing is anchor point for engine, replacing former torque rod between the block and body panel.



Straight-Line Electric Motor Promises 200-m.p.h. Train

RAILROAD TRAINS run in straight lines, but their electric drive motors, strangely, spin in circles. And it takes mechanical gymnastics to convert one motion into the other. The logical question then is: Why not make a motor that gives straight-line power from the beginning?

This is precisely what the British are doing right now. Their fantastic goal: a 200-m.p.h. train with no drive wheels and no moving parts to wear out or make noise.

In a cluttered laboratory at Manchester University I watched Dr. Eric Laithwaite, a 40-year-old electrical engineer with the build of a football tackle, climb into a weird cart.

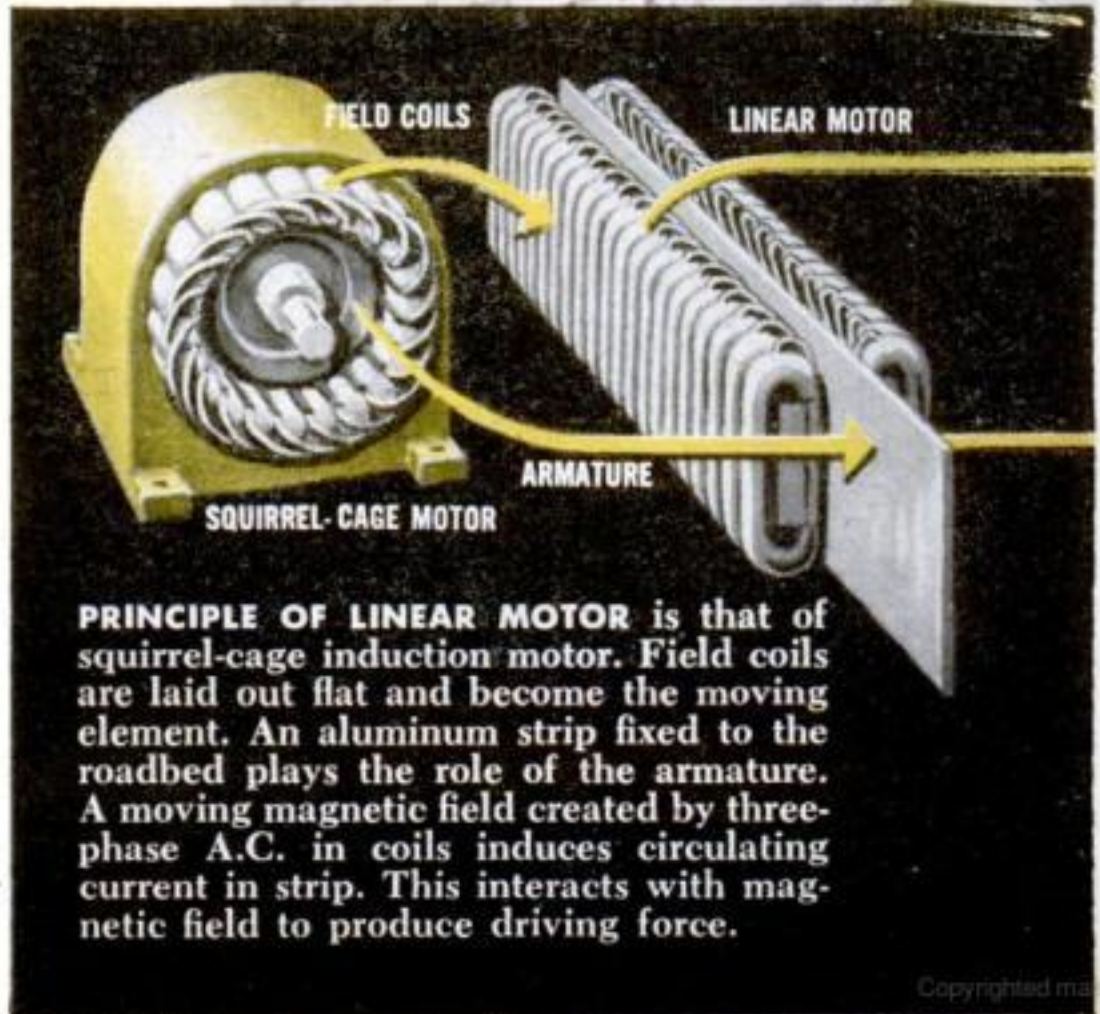
All aboard-r-r-d! He snapped a switch. Like a stone from a slingshot, he flashed down an 80-foot aluminum strip. The only sound was the swish of air. At the end of his run, Laithwaite grinned at me, snapped the switch again, and sped silently backward as swiftly as he had gone.

"This accelerates from rest to 25 m.p.h. in one second flat," he told me, straightening his broad shoulders. "It's like being clouted on the back with a heavy plank!"

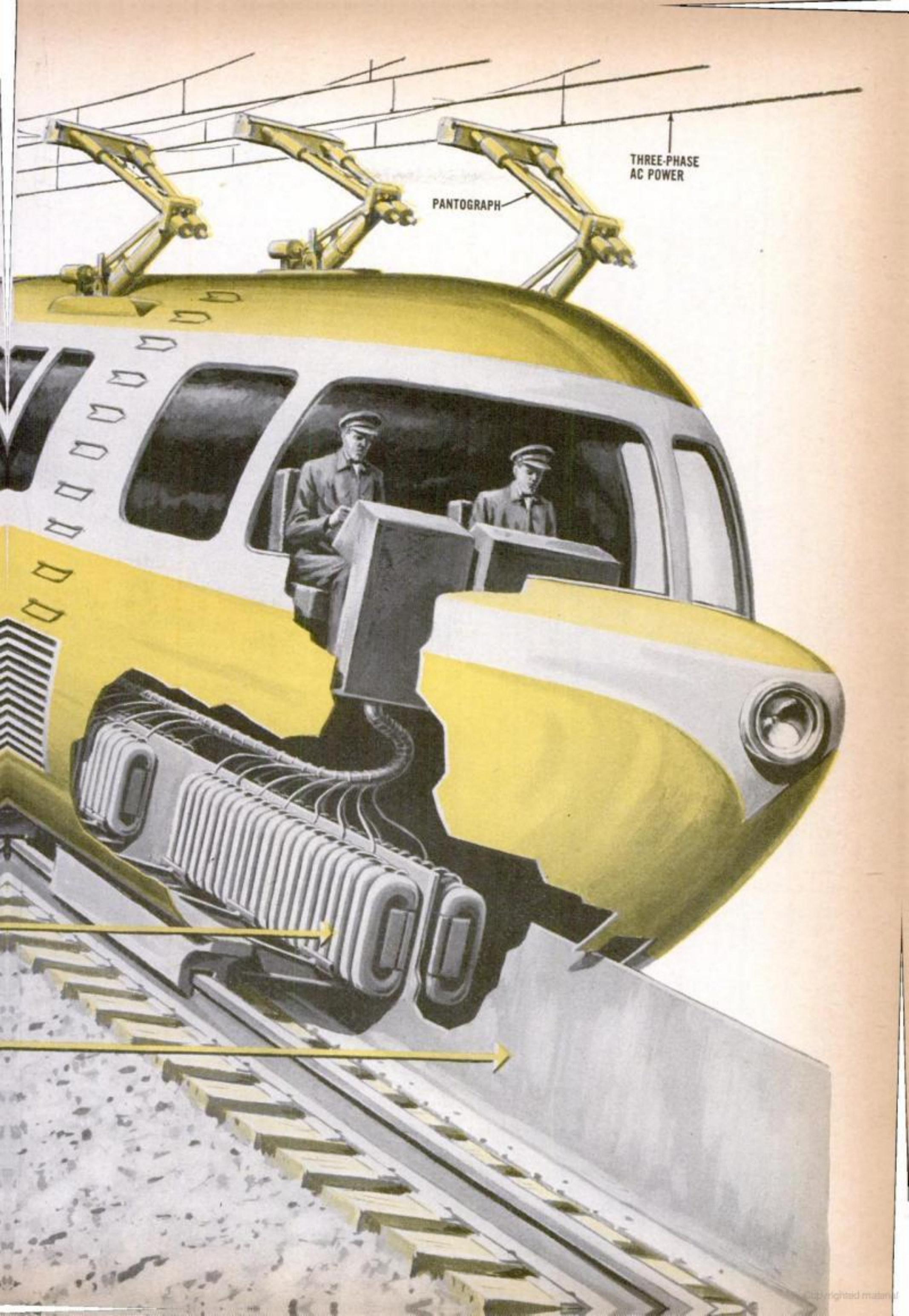
Laithwaite's cart could be the crude forerunner of the 200-m.p.h. locomotive of the future. It pulls itself electromag-



"LEVAPADS" SLIDE
TRAIN ON
FILM OF AIR



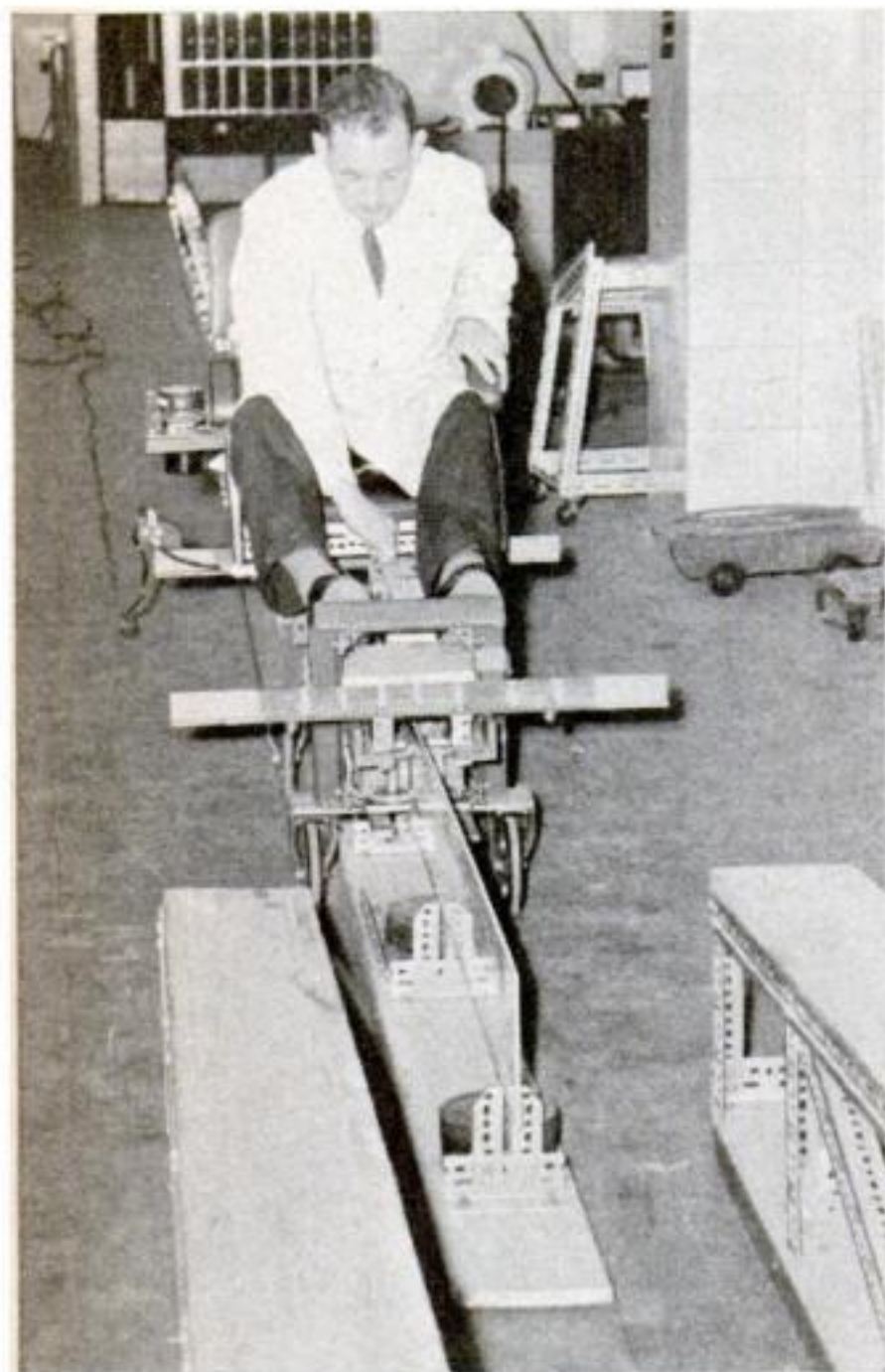
PRINCIPLE OF LINEAR MOTOR is that of squirrel-cage induction motor. Field coils are laid out flat and become the moving element. An aluminum strip fixed to the roadbed plays the role of the armature. A moving magnetic field created by three-phase A.C. in coils induces circulating current in strip. This interacts with magnetic field to produce driving force.



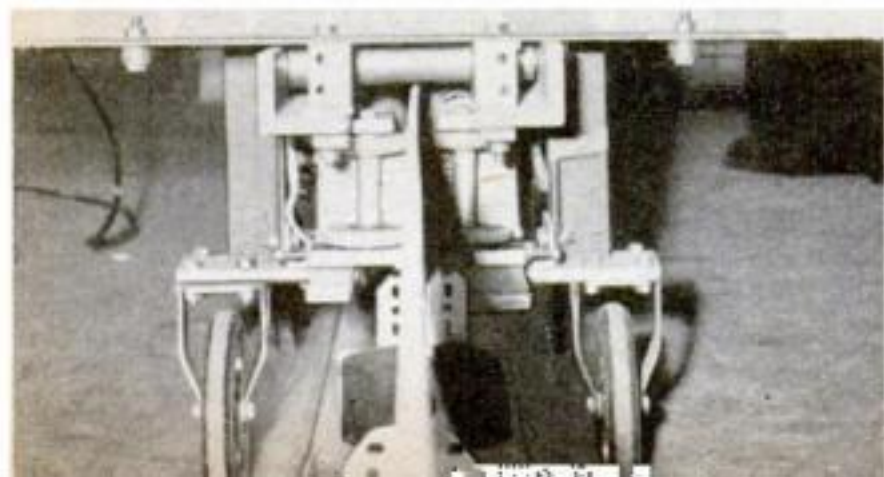
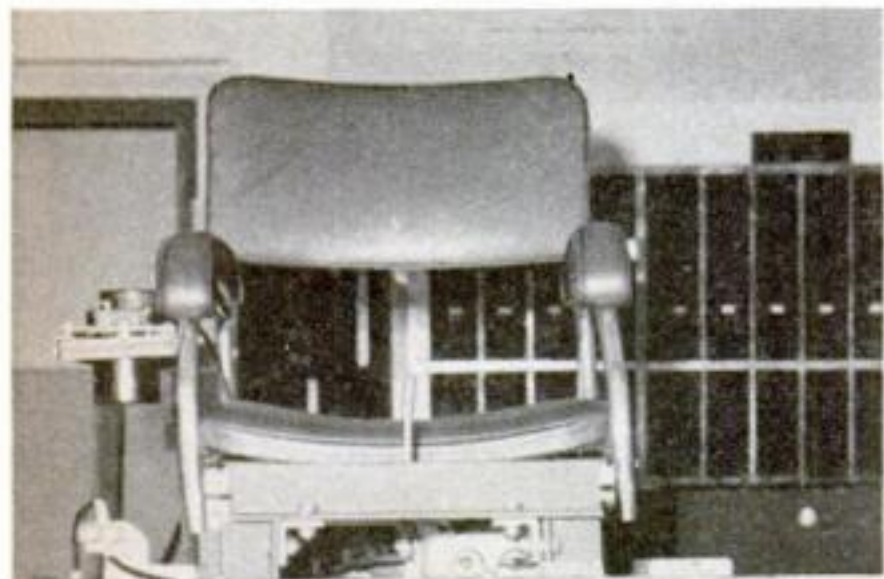
THREE-PHASE
AC POWER

PANTOGRAPH

netically along the aluminum strip with a "linear" motor. The locomotive carries only half the motor—the coil windings. The other half is the aluminum strip, which is laid down along the ground like a track.



AT END OF RUN, Laithwaite snaps control switch to reverse. Crossbar at front of trolley rides up wooden safety ramp to drag car to a halt if the regenerative braking fails.



You can see why the official British Transport Commission is enthusiastically planning full-scale tests. The linear motor converts electricity directly into motion without spinning shafts, gears, or wheels. There is no need for any moving parts at all, except for the railroad cars themselves.

Since the drive doesn't rely on friction between rails and wheels, the locomotive can be light in weight. It *should* be light because it carries only half the motor. There's no problem of wheels spinning on grades or ice, because the wheels don't drive.

Wheels probably won't be used anyway; they would cause trouble at 200 m.p.h. A strong possibility is a wheelless, air-supported train: Jets of compressed air would lift the cars a fraction of an inch off the rails. The train could glide along at any speed on the thin film of air.

Laithwaite's one-man model runs 80 feet and hits a top speed of 25 m.p.h. This performance is so promising that British Transport is now building an experimental 200-yard track in London. It is designed for a full-size railroad car running at 100 m.p.h. on wheels. The next step, already planned, will be a line seven miles long designed for 150 m.p.h. The first commercial linear-motor train may be a monorail connecting London airport to the city center. Two British companies are working on the monorail scheme now.

It's not magic. The linear motor that promises such fast, smooth travel is engagingly simple. It is nothing but a squirrel-cage induction motor sliced open and rolled out flat. The armature—now straight instead of a cylindrical cage—is the aluminum strip on the ground. The field coils—now straight instead of circular—are on the locomotive. Electromagnetism generated by the field coils pulls

[Continued on page 200]

RUBBER-TIRED GUIDE WHEELS (left) center the aluminum armature strip between linear motor fields. Rolled-out stator, shown below, produces straight-line instead of rotary motion.



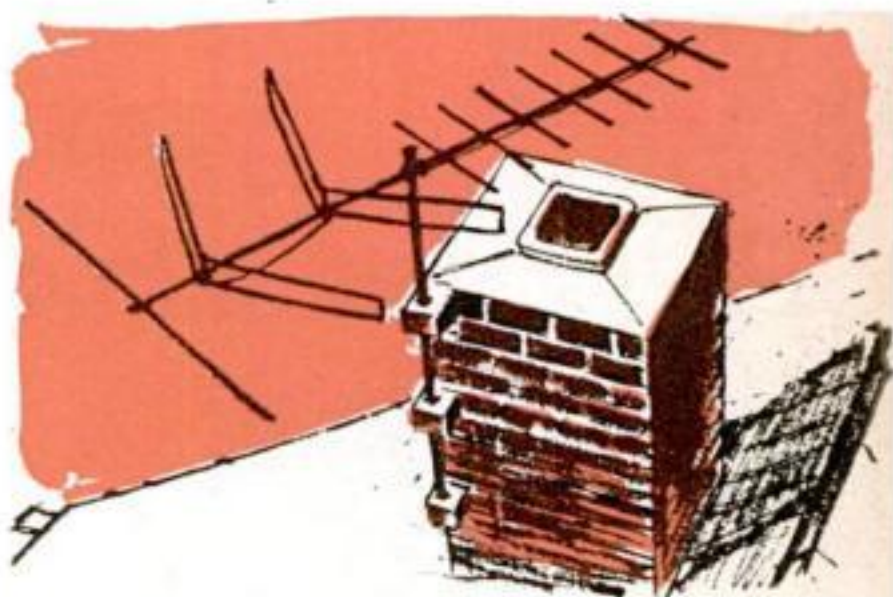
"I'd like to see them make..."



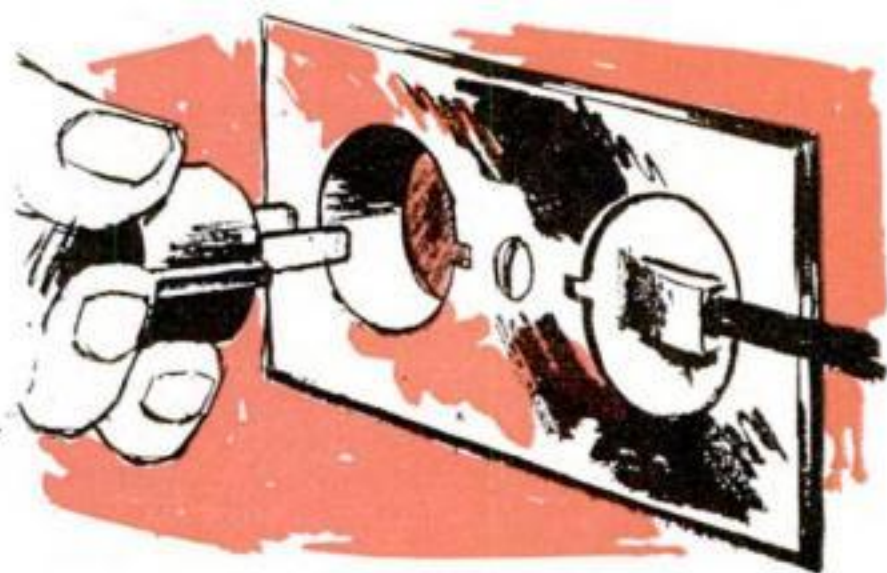
A DROPOUT WINDOW, like the emergency door in a bus, on each side of the house. With shade, screen, or storm window, it would fall out for fire exit.—R. A. Shaw, Ardsley, N. Y.



A SLIDING PASS-THROUGH COUNTER between kitchen and dining room. You could load from either side and slide the section through on tracks.—A. C. Dumont, Hackensack, N. J.



CHIMNEY POCKETS for TV antennas. A vertical row of L-shaped bricks with holes in jutting ends would do it. Align the holes to form a socket.—Ray Moore, Wellsville, Ohio.



RECESSED OUTLETS with plugs keyed for insertion. Flush with a wall, plugs would be less noticeable and would interfere less with furniture.—A. R. Shulman, Wantagh, N. Y.

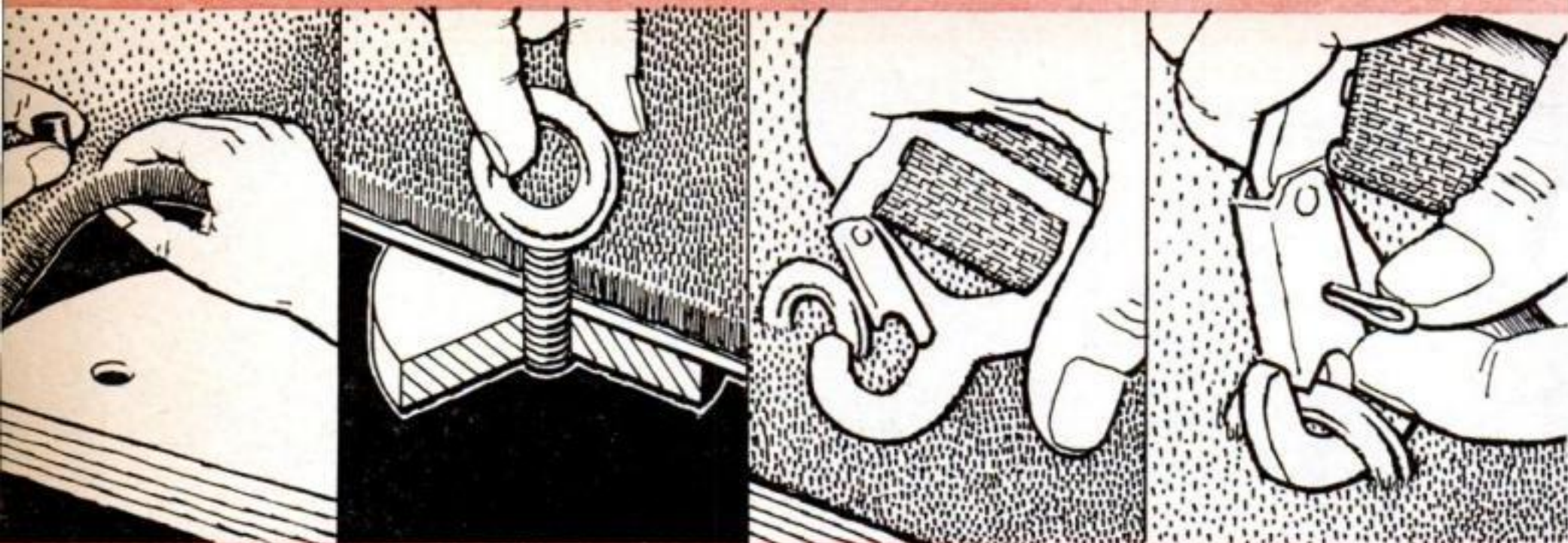


TUBE-PACKED PEANUT BUTTER that you'd squeeze out like toothpaste. Then you could spread it easily on a sandwich, without tearing the bread apart.—Ross Sloat, Goshen, Ind.

Everyone has his own pet idea of a gadget that he would like to see in general use. What's *yours*? We will pay \$5 for each one published. Please use Government postcards

only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 17. Write your name and address clearly. Contributions cannot be acknowledged or returned.

Author applauds this industry-wide innovation: seat-belt anchors



IT'S QUICK AND EASY to install front-seat safety belts on any 1962 U.S. car. All now come with built-in belt anchorages—heavy threaded plates welded under matching holes in the

floor pan just behind the seat. All you do is: (1) lift the floor mat and remove rubber plug from hole; (2) screw an eyebolt through mat and into the threaded plate; (3) snap the belt

Safety Expert Rates the 1962 Cars

By Paul W. Kearney

Noted authority on highway safety

FIVE years ago an automotive engineer in one of the Big Three companies showed me a collection he was making: news photos of motorists who had died in accidents *because* they were wearing seat belts.

Today this same engineer is pointing with pride to 1962's industry-wide innovation: factory-installed safety-belt anchorages on all models.

Combined with Chrysler's dramatic decision last January to offer seat belts at cost, this step merits applause. But it still leaves untouched the basic problem of getting the belt around the guy's middle—a matter to which we'll return shortly.

Thus does Detroit seem to move forward sideways toward crashproof design. The crablike nature of the progress is evident from the unfortunate fact that this step in the right direction is offset by several other steps in the wrong direction. For instance:

While the '62 Lark retains its excellent

knee pad on the lower edge of the dash, it now adorns the steering-wheel spokes with a chrome horn bar that resembles a woodcutter's splitting wedge. It could also achieve similar results on your rib cage in a crash. Pontiac too has moved away from the deep-dish wheel by raising the hub.

GM removed all protruding knobs and buttons from the right side of the dash as far back as 1953. Yet nine years later these plastic-surgery promoters are sneaking back in the Olds F-85, the Corvair, the Buick Special, and most noticeably in the Tempest. They stick out from radio sets attached below the center of the dash at knee level. The unpadded casings themselves menace the right front passenger. The knobs compound the hazard. At this rate we'll soon be as bad as the MG and some of the other knob-encrusted imports.

Take another detail: those knee-shattering window cranks and door levers. The '62 Pontiac is inferior to the '61 in this respect. The variation there can be in a single line is strikingly apparent in

built into all models



into eyebolt; (4) insert cotter pin to lock the snap; (5) slip the belt through the loop at back of seat and adjust to proper length.

Chevrolet. The standard Chevrolet is pretty good: Most knees will go between the crank and the lever in a forward lurch. The Corvair is bad. But the new "senior-compact" Chevy II is by far the best of the three. What kind of engineering produces such a variety of results under a single roof?

Oscars for safety. GM deserves an Oscar for the most striking safety advance on any new car. This is Cadillac's cornering light: a nine-inch, 50-candlepower tubular lamp extending back along the fender from the headlight. When you switch on your turn indicator and cut the wheel, this lamp throws a strong beam at a 50-degree angle to the side toward which you are cornering. It fills the dark void left by the headlights, and is a valuable antidote to clobbering pedestrians, traffic cops, hydrants, or mailboxes. It is definitely one of those "why-hasn't-somebody-done-this-before" advances.

Cadillac shares with American Motors cars another mechanical safety advance: a split braking system. If your front brakes fail through a loss of hydraulic fluid in the master cylinder, you still have the rear ones—and vice versa.

Three of the outstanding improvements

throughout the industry are simply a return to common sense rather than new developments. These are: the disappearance of the "wrap-around-over-and-under" windshield and backlight, with their ever-present distortion; greatly subdued instrument panels; and the almost total absence of pedestrian-stabbing and visibility-cutting fins. Only the Caddy remains caddish in this regard, and its fins aren't too bad.

While Detroit made a big noise about the "fabulous visibility" afforded by the glass cars of recent years, this proved to be wishful thinking. Neither the rear-view mirror nor the windshield wipers have kept pace with the glazing.

Chrysler is also entitled to an Oscar for its treatment of the dash in all its brands. The right-hand segment slopes away from the passenger at top and bottom; and it is free from edges, moldings, or gimmicks like those "eyebrow" hoods.



Safety expert notes improvements on '62 cars—and room for more

Chrysler Corp.'s instrument panels are also refreshingly sensible. First of all they use black backgrounds, instead of chrome or anodized aluminum, for dials and gauges, with white figures or red pointers. The Valiant panel is the best in this respect, but the others show what can be done to civilize a cockpit. (Buick and Thunderbird have also gone for black backgrounds, but both still retain too much brightwork that can cause reflections and glare in the windshield.)

Another Chrysler innovation is according the engine instruments virtually equal status with the speedometer. Instead of

being isolated in the extreme corners of the panel where they are out of sight and out of mind, they are now in plain view near the center. In this detail, the Valiant, Lancer, and Plymouth are much superior to the Dodge Dart and Chrysler, which retain a little too much glamour.

The importance of conspicuous gauges increases as superhighways multiply. On New York's Thruway more than 20,000 drivers a year are let down because they don't watch these instruments. And every letdown is a potential accident.

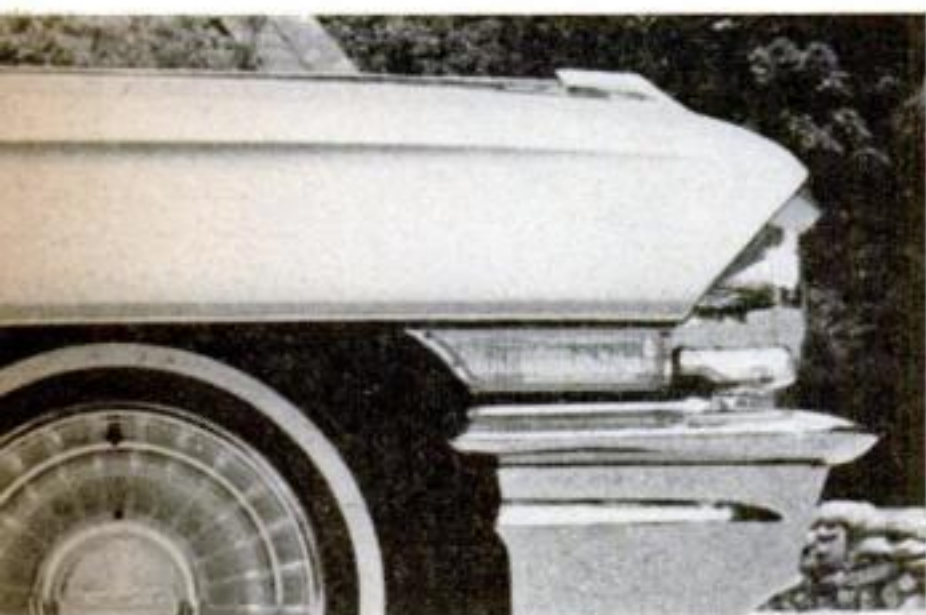
Safety you can't see. Ford gets its Oscar for three across-the-line improvements. Two of these won't be seen—or perhaps even appreciated—by the public. They are a much improved impact-proof latch and a superior seat-track anchor. A lot of Ford customers will stay alive because of them!

The third improvement is in a department we've been harping on for five years: freedom of foot movement for the rear-seat passengers. In most other lines, feet and ankles are pinned down securely by the front-seat frame—where they can be sprained or fractured in accidents or even sharp swerves. Rear footroom in Ford products is generally the best in the business. Among GM offerings, Pontiac is tops; in Chrysler's, the little Valiant is better than the big Chrysler 300!

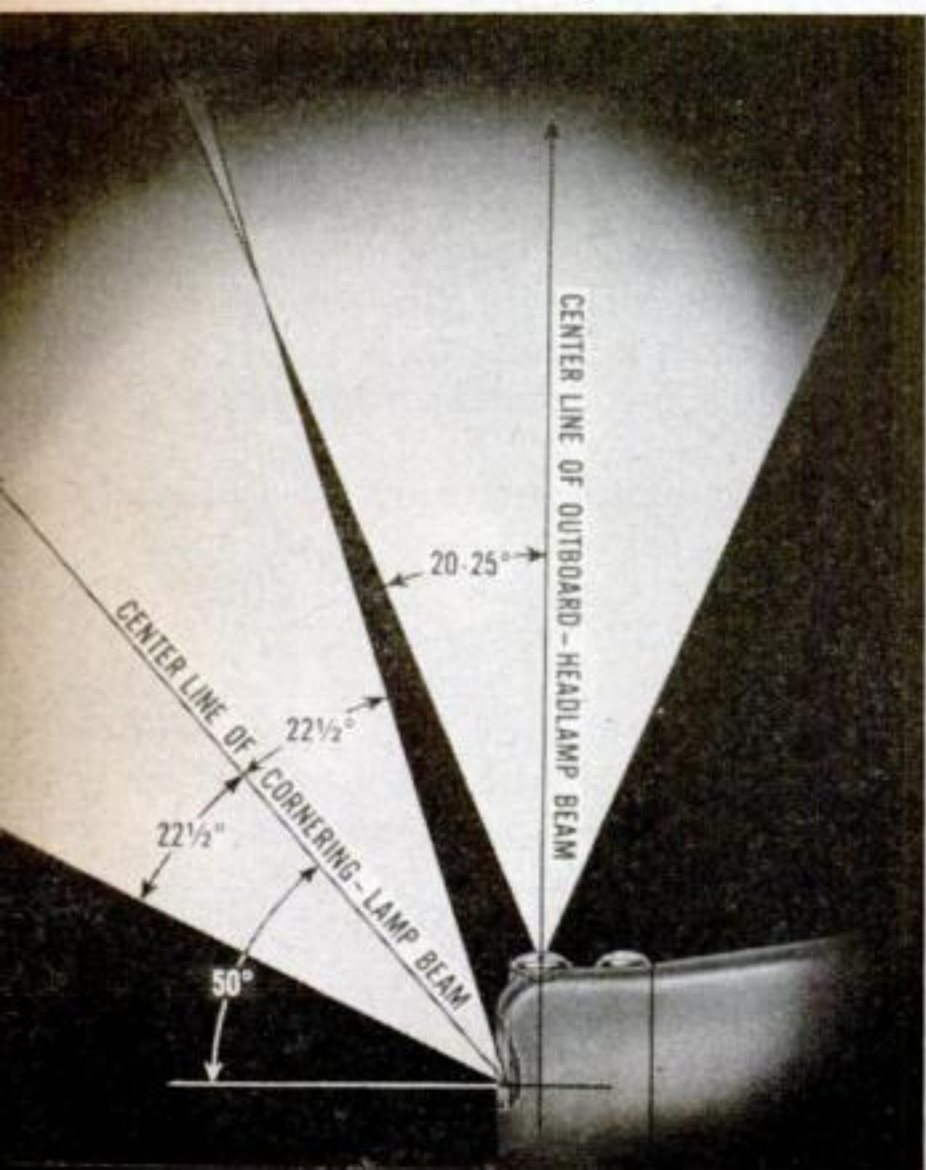
A hint of another hopeful trend is Oldsmobile's reduction of the steering-wheel diameter by one inch (with power steering). It's hard to understand why the power-assisted steering wheel has grown so cumbersome and obnoxious that Thunderbird offers a movable steering post to let an adult crawl into the front seat.

Plymouth, Dodge, and Imperial took a real bite out of this problem last year (and retain it in '62) by flattening the top and bottom of their wheels into a rectangular shape, much as the original Mercury Turnpike Cruiser did. The new wheels also increase the short driver's visibility.

Belts help—if. It may seem ungrateful to react so tepidly to the new seat-belt anchorages, standard on all '62 cars. But the basic problem is not only to sell belts



CORNERING LIGHT on Cadillac, extending back along fender from headlight, is hailed by the writer as year's "most striking safety advance on any new car." When you flick the turn signal and cut the wheel, it throws a beam (below) to the side toward which you are cornering.





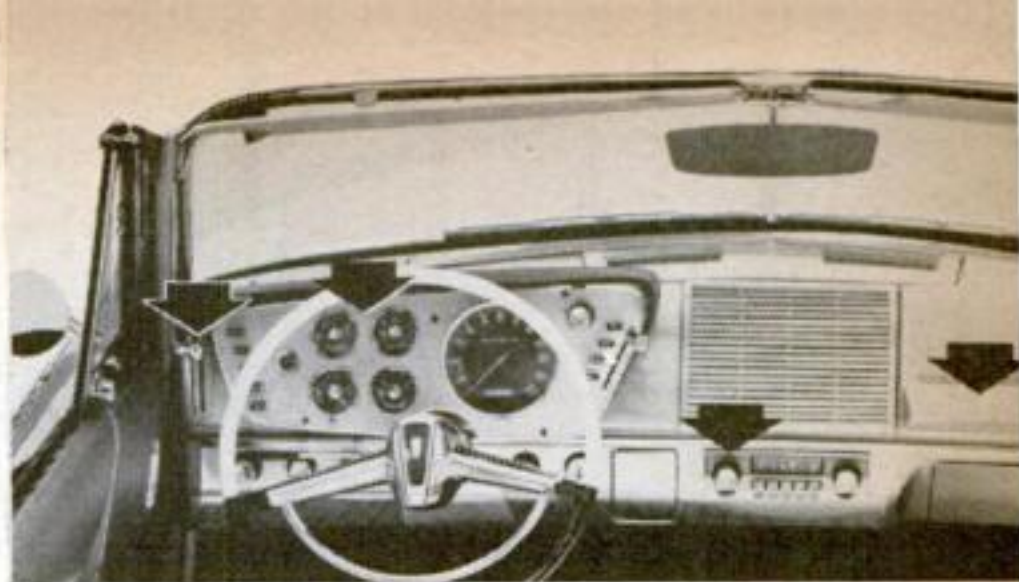
PADDING, seen along bottom of Lark's dashboard, as well as across top, wins praise. So do recessed radio controls. But author criticizes sharp-edged horn bar on steering-wheel spoke.

—which Ford did with some success—but to sell the public on *using* the belts after buying them.

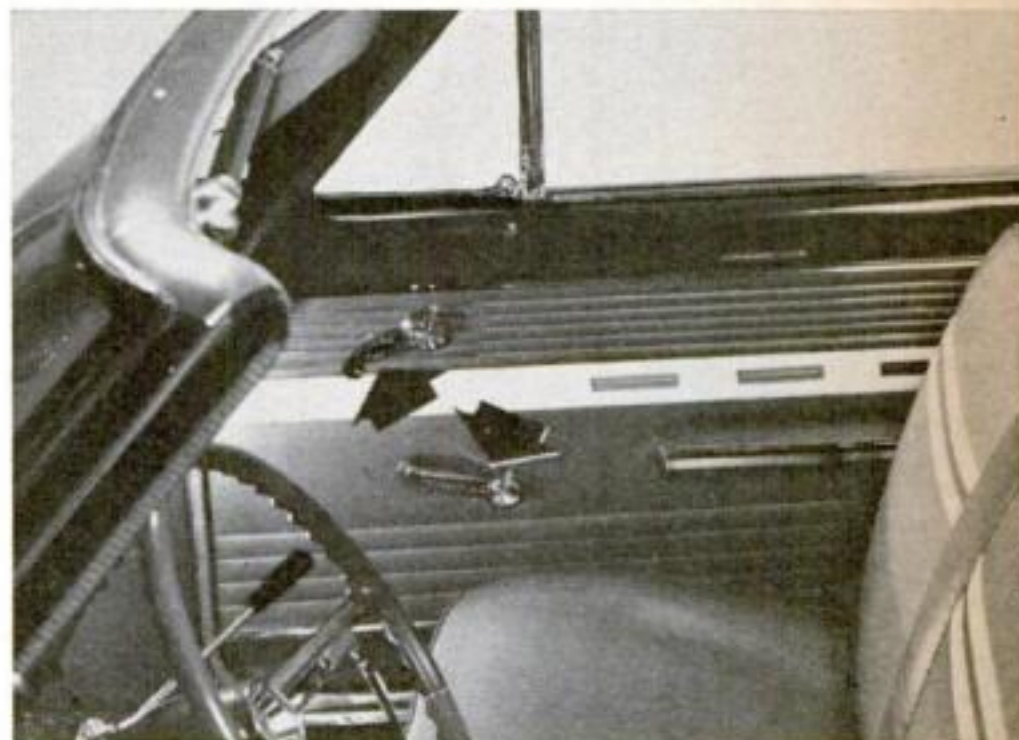
Seat belts have been generally available for six years. But a careful study of 54,348 accidents in California showed that only 3.5 percent of the cars involved had belts. The worst part is that only one-third of those belts were being used.

Now the Advertising Council, in cooperation with the National Safety Council, the auto industry, and the Federated Women's Clubs, is pushing a \$7,000,000 campaign promoting the use of belts. While this is about six years late, it is certainly better late than never. Whether it succeeds depends, ultimately, on you and me. ■ ■

LITTLE-NOTICED IMPROVEMENTS on all Ford cars are pointed out below on Falcon: stronger seat-



DIAL SPEEDOMETER and Plymouth's easy-to-read gauges (not lights) get safety expert's approval. He also likes dash contour, recessed knobs, and (at left) effective parking lock.



DOOR AND WINDOW HANDLES on new Chevy II are placed where they can't crack knees in a lurch forward. But in sister-car Corvair, writer says, this hardware is not so safely located.

track anchor, more rugged door latch, ample footroom for the passengers in the rear seat.





INSTRUCTOR IN TOWER from which he can watch traffic pattern radios directions to three cars in same section of driving range. With aid of radio, five cars use oval at one time.

Learning to drive by ear



STUDENT GETS POINTERS on operating two-way radio. She is not allowed to talk back to tower except when the car is parked.

Students at Walter Johnson High School in Bethesda, Md., learn to drive on an oval asphalt track laid out to resemble highway and street intersections.

They are steered past potential trouble spots by two-way-radio connection with an instructor stationed high above them in a control tower from which he can watch traffic. Another instructor on the ground helps the learners with problems that arise.

With the help of radio, five cars may now use the driving range at one time. Its first year of operation enabled 500 students to take the course instead of 200 handled the year before.



Doubles as gondola and boxcar

Sliding roof and sides on a new German railroad freight car permit fast loading either by an overhead crane or fork-lift truck. The half-length roof and side panels of light alloy are mounted on rollers for easy movement. They can be locked shut to balk thieves.



Up hill, down dale

A bulldozer pulled a mile-long stretch of aluminum gas pipeline down one mountain and up another in Kentucky's lofty Appalachians. Normally, 40-foot lengths of pipe are laid first and then welded together by bringing equipment to them, a tough job when the ground is rough.

Here, all welds were made atop the first crest. The bulldozer snaked the flexible pipe from peak to peak.



No-wire telephone

Here's a telephone with "no strings attached." Its only wires connect the receiver to a two-way radio inside the base.

It's an experimental model built by Automatic Electric Laboratories, Northlake, Ill., to replace plug-in phones in restaurants and public places. It won't be on the market soon, though; there aren't enough frequencies.



The Meanest Hog in the World

By George Laycock

IN THREE widely separated mountain sections of the U. S., herds of wild European boar roam in freedom. One of the meanest, ugliest animals known to man, this ferocious ancestor of our breakfast bacon averages 225 pounds, but he may go to 400 and stand three feet high at the shoulders. Like the bison's, his back slopes toward the rear quarters. His mule-like tail carries a brush at the end. Sharp, hairy ears project above his beady black eyes.

His snout is long, knobby, and wedge-shaped. Curving upward from his upper jaw his canines form a pair of razor-sharp tusks, self-sharpened constantly against the lower canines. The big boar's tusks may be half a foot long. He uses them for ripping roots from the ground, because roots, along with acorns, fruit, birds' nests, and carrion make up much of his diet.

Cornered, few animals are more unpredictable or dangerous. He may stamp his strangely dainty feet, lower his snout, grunt, froth at the mouth, and come straight for you. His tusks are deadly. Says one mountaineer, "Them tusks can rip a hound from stem to stern, or lay open the leg of a man. What's more, the hog knows it."

Big timber rattlers, feared by nearly all

animals of the forest, are delicacies to the European boar. Even while the rattler sounds his warning, the boar stamps him to death beneath his sharp hooves and eats him on the spot.

"No other animal in the country," says veteran wild boar hunter H. H. Shelton, "will accommodate you quicker with a fight." Brought to bay, the big hog seems to sneer at the howling dogs. Only the most courageous packs of hunting hounds, specially bred for this work, will risk their lives against the murderous boars.

Wildlife biologist Perry Jones, who studied the habits of the European boar in North Carolina's mountains, points

CONTINUED

"COTTON" McGUIRE LIVED LIKE A HERMIT in the North Carolina mountains for 31 years, became an authority on the ways of the wild boar.



**"... only North American animal
with a bulletproof jacket"**

out that the animal has an extremely thick layer of cartilage over each shoulder. "A hound's teeth cannot rip it," says Jones, "and it will stop any small-caliber rifle bullet." This hog is probably the only North American animal equipped with a bulletproof jacket.

At birth the European or Russian boar has light stripes running lengthwise through his dark coat. Beneath the stiff bristle is a layer of soft woolly hair, trademark of mammals that live through cold winters. The young lose their stripes in a few months and afterwards are a uniform grayish black.

Night prowlers. Wild European hogs feed mostly at night. They wander alone or in small herds, sometimes a distance of 12 miles in a single night. As they move they are nervous and alert, seldom feeding long in one spot. They are among the most agile animals in the woods. They can dash along rocky mountain trails, over streams on logs, and skitter nimbly through the thickest cover.

Long since exterminated from the British Isles, the wild boar still inhabits the wooded mountains and thick swamplands of Russia, Germany, Spain, and Austria where for centuries he has been fabled for his ferocity.

The biggest herd in this country is estimated by wildlife biologists at 1,100. These hogs inhabit the wild thickets and mountain-laurel tangles on the slopes of the Smoky Mountains along the Tennessee-North Carolina border. They've been there for nearly half a century.

The strange tale of how they got there starts with a plan hatched in the fertile mind of a New York business tycoon back in 1909. That was the year George Gordon Moore began building a hunter's paradise around a mountain peak in North Carolina. There on Hooper's Bald, he established a preserve where he could entertain visiting businessmen.

He had 25 tons of fencing hauled up the rock-strewn slopes to Hooper's Bald, elevation 5,429 feet. He built two big pens there by stringing wire through the woods and nailing it to trees. One was for buffalo and other assorted game. The



UGLY, AGILE, AND MEAN, the wild Russian pig weighs up to 400 pounds. He feeds mostly at night, eats everything from roots to rattlers.

second pen was called the "boar lot."

Excitement ran high around the mountain settlement of Murphy, N. C., in April, 1912 when cargoes of strange critters began arriving on the train. Some of the crates held as many as 14 wild hogs straight from the Ural Mountains of Russia—home of the largest and fiercest wild hogs in the world.

A home away from home. They couldn't have found a more natural habitat. The Appalachians are surprisingly similar to the Urals. Both ranges are long and narrow and rise to mile-high elevation on the north and south. Both are heavily wooded wilderness areas with spots of almost impenetrable thickets where the hogs can hide out, have their pigs, and feed unmolested on the acorns.

On the mountaintop the hogs were released in the boar pen. A small crowd of natives had climbed the mountain to see them set free. For days they had repeated tales of the ferocity of these imported "Roosian" pigs. No wonder that, as the hogs dashed from their crates, some of the onlookers clambered up trees.

In due time, other animals shipped in by Moore—buffalo, elk, and brown bear—languished and died. Only the boars found the hills to their liking.

Moore hired a local tow-headed mountain boy named Garland "Cotton" McGuire as caretaker for the new venture.



THE FEARSOME LOWER JAW carries the massive canines against which the boar's razor-sharp upper tusks are constantly honed.



AT BAY, he seems to sneer at the yelping hound pack. Only the bravest dogs will risk their lives against a wild boar at close quarters.

McGuire was a quiet, hard-working, conscientious youth. For 31 years he lived a hermit's life atop Hooper's Bald and became, in time, the country's outstanding authority on the Russian boar.

But Cotton McGuire never liked the wild boars. "They take the food that bears better deserve," he said. Hard times caught up with Moore's operation eventually and he deeded over to McGuire all the property on Hooper's Bald, animals, hunting lodge, kennels—everything.

The hogs meanwhile had multiplied. In the boar lot were 60 to 100 head.

Too mean to die. McGuire called in all his hunting companions for a big free hunt for Russian boar inside the pen, the first such hunt in the Great Smokies. It was a hunt they never forgot.

The hunters entered the wooded field and turned their hounds loose to bring the hogs out of the brush. Before long there were hogs, dogs, and hunters dashing in every direction. Many of the wild hogs broke through the fence and escaped into the surrounding mountains. Other hogs turned on the dogs and men.

When the hunt was over, two hogs had been shot. But a dozen dogs lay dead. Several hunters had taken to the trees.

In a strange way these boar continued to be a source of income for Cotton McGuire. Hunters, wanting the unusual experience of shooting a wild Russian boar, came from all over the country and

they hired McGuire to guide them into the mountains for the chase.

In California's Los Padres National Forest is another herd of 600 wild Russian hogs. And there is a small herd of between 20 and 40 in New Hampshire's Sullivan County where they escaped from Corbin's Park during the 1938 hurricane.

The California herd came originally from Hooper's Bald. Who wanted them sent to the coast? The name is familiar. George Moore asked Cotton McGuire to trap and ship them there to him.

As wild as ever. Today the Russian boar in the Smokies make their homes in the tangled laurel "hells" far up the mountain sides. They bed down in the thickest brush and show no desire ever to see man or dog. The sow hides out in a dense thicket or a rocky ledge to have her four or five pigs. This may happen at any season. They begin to get tusks at one year of age and a half year later have reached sexual maturity.

North Carolina and Tennessee permit hunting of the ill-tempered hogs in controlled hunts during fall and winter months. Not many are taken.

Just what value he has is debatable. Few defend him as meat on the table.

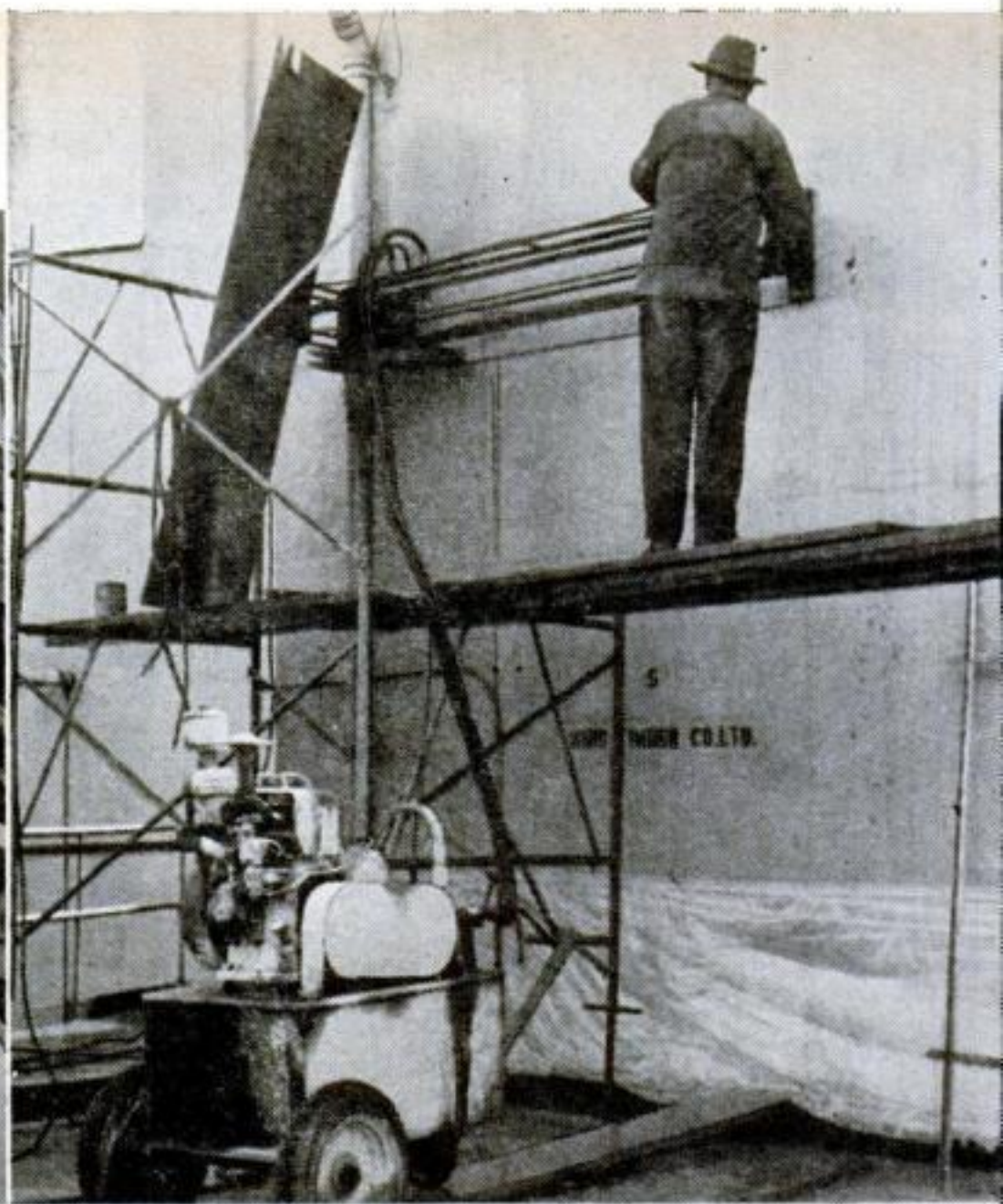
Cotton McGuire, who died of a heart attack in 1957 when he was 62, summed up the character of the meanest pig in the world with a single sentence. "Those hogs," he said "are hateful." ■ ■

Circular saw cuts through concrete



WHIRLING SAW takes first slice in eight-inch wall, controlled at one end of track by two handles manipulating sprockets and chains.

Because cutting doors and windows in reinforced-concrete walls is tedious and expensive, a Canadian contractor invented a hydraulic saw to do the job. With it, J. T. Doyle of Vancouver, B. C., can cut a window like the one above for only \$80 and still make a profit. A



HYDRAULIC POWER is transmitted by gasoline pump on ground to motor, driving saw along guide rails attached to wall of building.

similar job, done by drilling a series of holes with a diamond drill before he rigged up the saw, cost \$700. Another method is with a jackhammer, but it's too noisy for use in an occupied building.

Doyle's invention is a 24-inch diamond-tooth circular saw powered by a Vickers-



Chinese junk has motor push

An outboard motor has been added to give a modern touch—and more power, too—to this traditional Far Eastern vessel. The two-ton Chinese junk, the Sea Dragon, is owned by two Britons, Mr. and Mrs. John Warner. They are shown here maneuvering it out of a yacht basin on the Thames in Surrey.



VERTICAL CUT is taken with guide rails and saw remounted along what will be one side of window. Rig is held by bolts or suction cups.



NEAT AND ACCURATE CUTS permit insertion of window casing and sash right in sawed hole without need of further trimming or fitting.

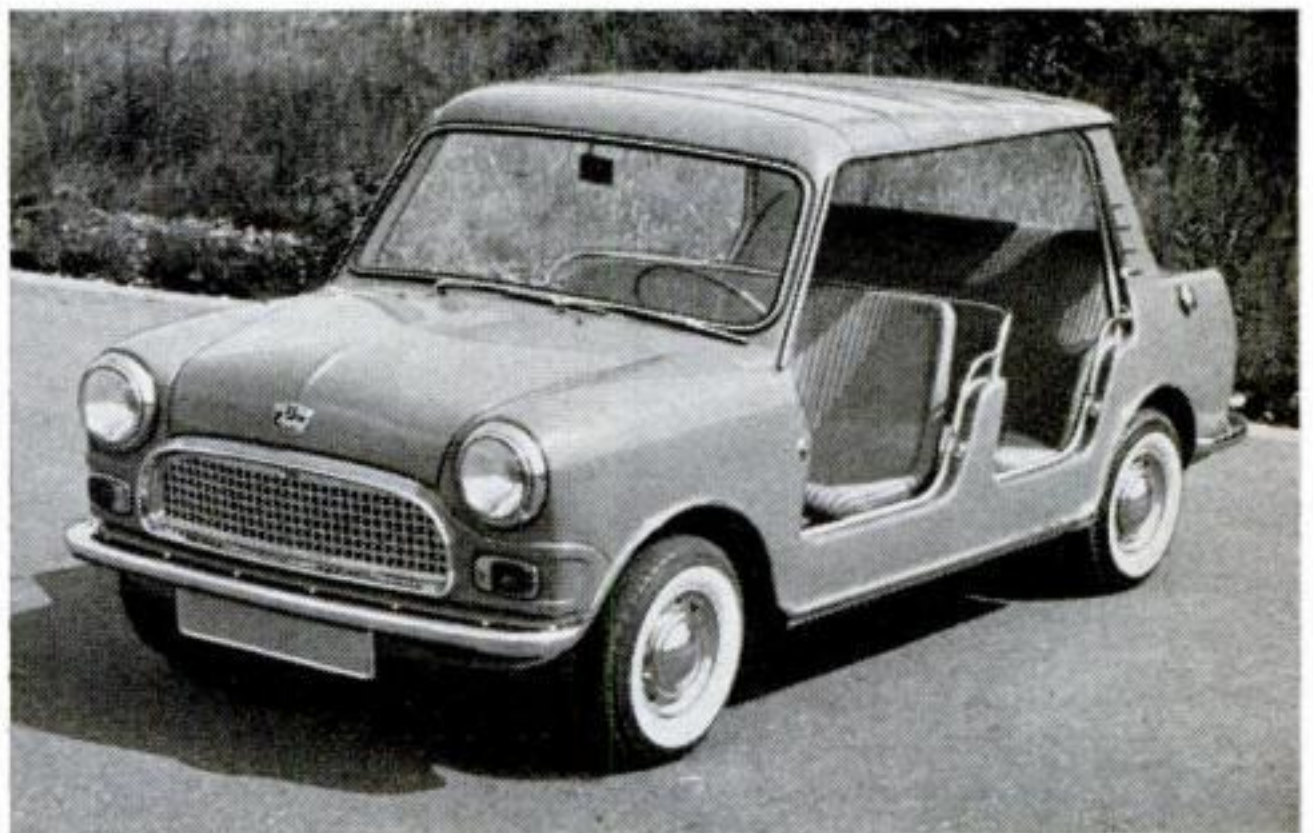
Sperry hydraulic motor working on fluid pumped by a gasoline engine. The saw runs along guide rails bolted to the wall or held up by suction cups. The motor weighs 36 pounds, much less than a gas or electric motor of comparable power, and can be operated in any position. The

whole outfit—guide rails, saw, and all—weighs 240 pounds, light enough to be handled on a scaffold by two men. After the saw is mounted, one man can operate it from one end of the track by two handles in a chain-and-sprocket system that moves it laterally and prevents sway.

Beach car for warm resorts

Designed as a sea-side runabout, the little British car at right, based on the Austin Seven and Morris Mini-Minor, has wickerwork seats and open sides and rear.

Wheelbase is longer and the trunk larger than the standard model's. A transverse-mounted engine drives the front wheels.





RADAR ANTENNA, mounted on window bracket, has the appearance of an innocent spotlight.



SPEED INDICATOR, transistorized radio unit, and graph recorder plug into cigarette lighter.

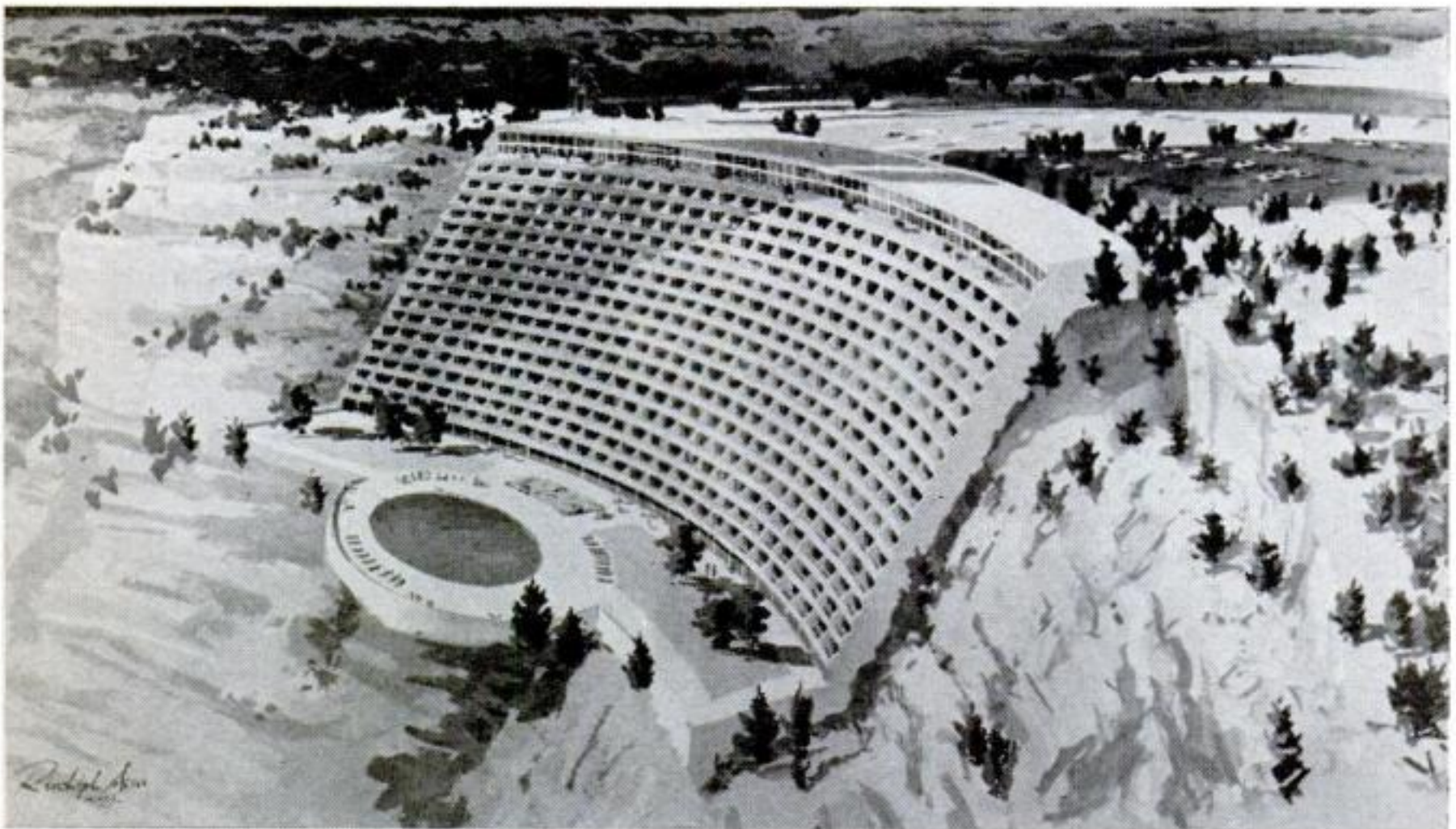
New radar speed-spotter rides with cops

Motorists, beware. That thing that looks like a spotlight mounted on the side of the patrol car behind you may be radar checking your speed. The latest police weapon against speeders is a portable device that can be shifted from car to car. It operates by plugging into the cigarette lighter on the dash.

Besides the "spotlight," which is the

antenna, it consists of a transistorized radio transceiver small enough to go in the glove compartment, a speed indicator, and an optional graph recorder for a permanent record that can be taken to court.

The unit, made by Automatic Signal of Norwalk, Conn., is being tested by the police of Westport, Conn., and by the Connecticut State Police.




Hotel perched on rim of Grand Canyon

An 18-story, 600-room tourist hotel is planned for the south rim of Grand Canyon in Arizona. This architect's drawing shows the building following the contour of the face of the canyon wall with each floor set back in step-like fashion with its

own private terrace. The entrance is at the top; a swimming pool and sun deck are at the base.

The hotel would replace the old Grand Canyon Inn on 20 acres of mine property owned by Western Gold and Uranium.



At express-train speed, the Yankee Jet roars up famous Horseshoe Curve, 44 minutes ahead of its own super-fast schedule. You're looking back from second engine unit.

Record-Breaking Ride on New Super-Freight

The Yankee Jet—the nation's hottest freight train—may be the herald of a new era of high-speed railroading

By E. D. Fales Jr.

PS PHOTOS BY W. W. MORRIS

AT 4:40 p.m. the other day a fast passenger express for New York was halted, as it left Boston, by a red signal. This was unusual, but the reason soon became apparent.

Creeping out of a slow freight track came a strange-looking freight train—half

piggybacks, half boxcars. Surprisingly, while the express cooled its heels, this freight was given priority. It was run in on the main line ahead of the express, and on the same high-speed track. For the passenger train it looked like a long, slow trip.

But suddenly that slow freight revved up and took off like a tornado. In moments it was out of sight. It was going

CONTINUED

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Just before train time, trailers are loaded on Jet—in double-quick



A special road-type tractor is behind this trailer pushing it toward car in foreground. Note collapsed stanchions.



Stanchion rises swiftly under front end of trailer. It will grip fifth-wheel kingpin shown above it.

to make a stab at outrunning the express.

And it did. I know, because photographer Bill Morris and I were in the engine of that mixed-up-looking freight—on a fantastically fast 1,262-mile trip to Chicago.

The Yankee Jet, pride of three railroads, is our nation's hottest new super-freight. It whips across New England on the New Haven, does some nostalgic back-country exploring on the Lehigh & Hudson, then climbs over the Alleghenies on the Pennsylvania. By some fancy

sleight-of-hand, plus speed, it chops an incredible 20 hours from the old running time.

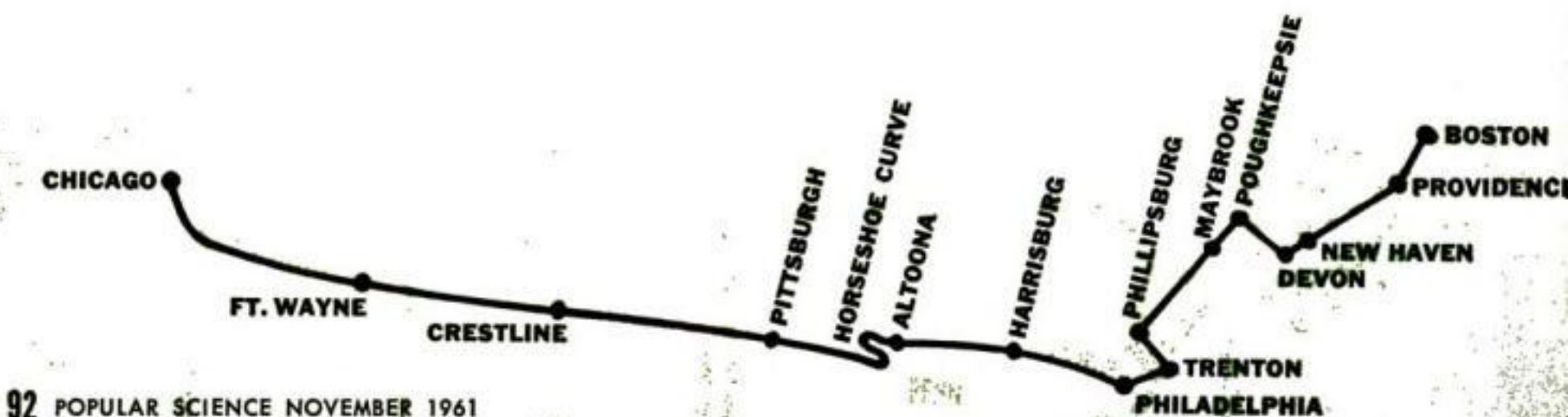
This minor miracle is, frankly, a bid by the three railroads and their 80,000 employees to get back business and jobs lost to the highways.

WHAT'S it like to ride such a "hot" train?

When we drove into the Boston yard at 3:30 p.m. all we could see were 24 boxcars and a few strings of empty flat-

Loaded and ready, Yankee Jet begins its race toward the West

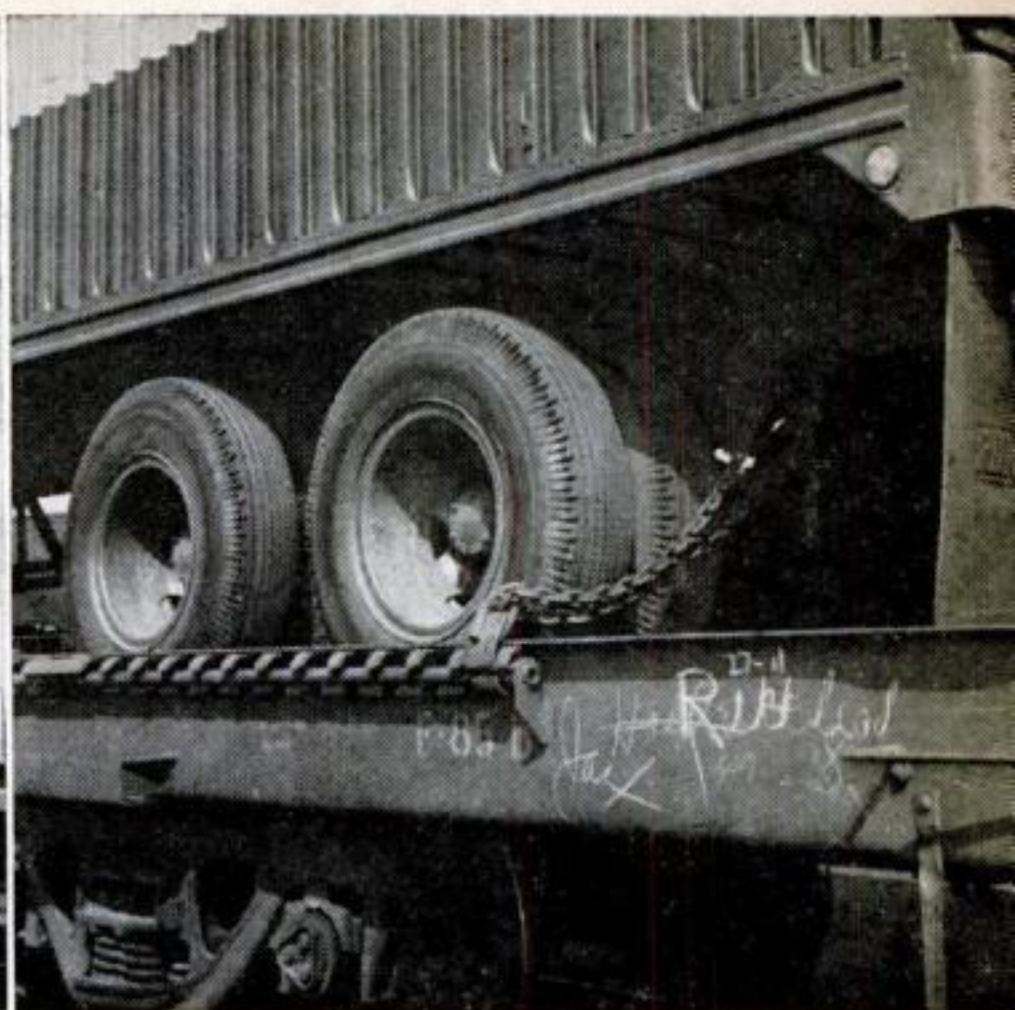
This is the 1,262-mile route over which the piggyback train (right), pride of three railroads, raced toward a record.



time. Trailer at far left is being backed toward camera at 15 m.p.h.



With stanchion in place, loading crew cranks up trailer's parking gear, which won't be needed during the run.



As a final precaution, heavy safety chains are lashed in place. But these are not supposed to bear load.

cars. No trucks. "Where are our piggy-backs?" we asked.

"Just wait," said a yardman. "For this train, they come in a last-minute rush."

3:45 p.m. Suddenly we saw what he meant. A monster blue tractor-trailer roared in. Within minutes the yard was full of trucks—trucks laden with furniture, whiskey, motors, coveralls, and maple sugar. As each roadhorse uncoupled, a special railroad "loading-horse" seized the trailer.

Behind a three-unit New Haven locomotive, Jet awaits a clear-track signal at the Boston freight yard.

Then came a show of skill. First to be loaded was the huge blue trailer, full of electronic parts. Steering only by mirror, the "loading-horse" driver backed it up a loading ramp 30 feet long and rushed it backward over six flatcars. He must have whipped it from car to car, over steel bridging aprons, at 15 m.p.h.

Then he released the blue box and raced forward over the train at a jostling 25 m.p.h. to get another trailer. A three-man team seized the blue box, lashed check-chains around its frame. Next they

CONTINUED

Streaking west, Engineer Willis (with author) fed power fast, soon had Jet running ahead of fast express.



What crews were doing during the record-breaking run . . .

produced a 1/2-hp., low-geared electric gun and screw-rammed a massive steel stanchion up hard against the fifth wheel. A jaw in the stanchion bit hard on the kingpin. This would be the anchor.

In three minutes the blue box was ready and another trailer was being marched on.

4:20 p.m. Two engines were now shuffling our train together. One hauled us down the yard to meet our three-unit road engine.

BILL and I swung up into the cab. The fish-horn burped twice. Head Brakeman Smoky Joe Wood, a wiry chap with a cap turned up jockey style, shouted down from the fireman's window: "Okay, Paddy. Give us the railroad."

"Okay. You're off," came a cry.

Smoky Joe hollered "Okay!" across the cab to our engineer. The engine thundered. We were off—three minutes late.

When we got out to the main line we saw that slick passenger train waiting unhappily, like a snubbed dowager. Our signal was green.

"Clear on the main!" Smoky Joe called happily.

"Clear on the main," echoed Engineer Joe Willis, and the race began. We had to stay ahead of that fancy express. More than that, we were going to try to set a new record to Chicago.

Until the Jet began running last May, the Chicago trip took 56½ hours or more. Spurred by competition, the railroads decided at last to shake off some sleepy



By light of a kerosene lamp, conductor and his flagman (left) make up their train reports in caboose of speeding train.

old methods: The Jet was the result. It was given a fantastically fast schedule—to deliver trailers to Chicago on the "second morning," before stores opened. The schedule called for four a.m. arrival.

No one thought it could be done. But one morning the crew, given a chance to show what they could really do, danced the Jet into Chicago an amazing three hours early. So her arrival time was pushed up to 1:30 a.m. Now we were making a try to beat that.

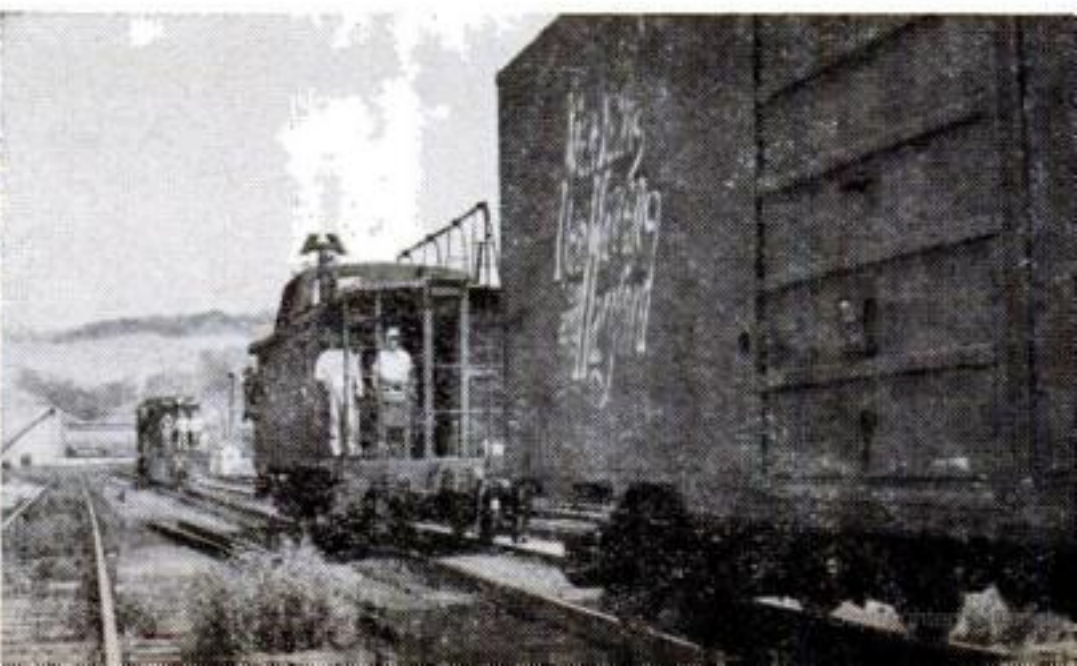
"If they 'give you the railroad' you might make it by tomorrow midnight," a crew member told us. "That would set a new record. But hang on tight."

Could we do it? As the Jet slid out on the main, Engineer Joe Willis opened the throttle. In his mirror we saw our big trailers following like elephants in

High-speed railroading clips off minutes

With Engineer Neal at throttle, our engine (left) overtakes a train being pushed up Horseshoe Curve by locomotive (right).

We came coasting into Altoona in the cabin car. Yankee Jet (right) ran off and left us rolling down track alone.





"Clear!" shouts fireman, who spots a signal ahead. Engineer acknowledged by echoing back a hearty, "Clear!"



Engineer Neal, biting into a fresh cigar, pours on oil and sends the train racing over the mountains toward Ohio.

a circus parade, marching in single file.

When the train was all on the main, Willis fed oil. Our 4,900 horses rumbled. Speed: 20—35—40. We passed the limit for fast freights—50 m.p.h.—and went right on up. The track streaked toward us like rivers of quicksilver. Towns swept by. Fireman Frank Palazzo tunneled back, checking motors, pumps, exhausts, circuit breakers. Smoky Joe called signals: "Green . . . green . . . green."

The Jet was picking up her heels now. Bill and I guessed our speed at 75. (There are rumors it has hit 90.)

5:05 p.m. In his mirror the engineer is watching those huge piggies. Smoky Joe watches, too, alert for hotboxes or sparks that mean something is dragging. "If anything ever happened," Joe says,

Again we save time at Pittsburgh. Here wheels and journals were inspected electronically, so train made no stop.



"our rear crew could stop us by pulling the air valve."

5:10. Smoky Joe calls: "I can see a hand out the cabin window." The engineer glances back. But the hand disappears, and on we go. We know the express is close behind.

5:33. We make Providence, R.I., in an hour flat—faster than many passenger trains. Now we see other ways the Jet makes time. We might have gone in the freight yards here, as other freights do, losing 40 minutes. But we scoot right into the passenger station just like the swank Merchants Limited. Here we break the train, run in six new cars—and are off in minutes before the express can catch us.

8 p.m. Our first crew change at New Haven, Conn.—the first of nine we will make, and at each change we will get a new cabin car. One switch engine yanks the old cabin car off, while another rams a new one in its place. Brake test. Whistles. A wave, and off we go again, dust flying, now seven minutes *ahead* of schedule. We've made a discovery: The Yankee Jet has put the old fire and pride back in railroading. We see it in the faces and waving hands everywhere. In towers, yards, stations, New Haven men peer at our wheels for smoke. But always we get the quick-raised hand (or light) that says, "All black. (No hotboxes.) You're doing fine."

9:18 p.m. They're *really* "giving us the

CONTINUED

railroad." The track's being cleared for us miles ahead. We're a little worried, though, about one "pig"—the big blue fellow. Our trouble: There are bridges ahead with a limit height of 12-feet-6-inches. But at Boston the blue trailer checked in 12-feet-7. Can we squeeze that extra inch through? We're going to try. But everybody wonders.

We leave the main at Devon, Conn., and take an improved new single-track through quaint old towns where citizens are just turning out lights. Now Bill and I are back in Conductor George Schoonmaker's cabin car. Skimming along, we learn from the crew that the Jet is a success because it cuts the cost of a Chicago truck-run from about \$300 to \$200, by railroad figuring.

We learn, too, that we are hauling three kinds of piggy cars: (1) 40-foot "Trailer-Train" flats, (2) 80-foot Clejon cars that can take two 38-foot trailers, and (3) monster new TTX cars, 85 feet long, that can take two huge 40-foot vans.

Near midnight our wheels scream into



Two minutes before midnight, Jet roared into Chicago yard. By radio, word already had gone out to truckers. Within moments, train was split in sections and trailers (below) were being unloaded and towed away.



a hard curve. Poughkeepsie, N.Y. In a moment we are cutting apart the night sky. We look down from the dizzy height of a bridge to a ship's lights on the Hudson river, 212 feet below. In order not to shake the span, the train crawls for 10 minutes. We're glad when we come to solid land and the vastness of the Maybrook, N.Y., yard.

WE CHECK watches. Midnight. We're 20 minutes ahead of time. We have 1,000 miles of tough railroading to go. To set a record, we've got to do it in exactly 24 hours. It begins to look impossible.

But we've reckoned without the wonderful little single-track Lehigh & Hudson, a real old-time railroad man's railroad, that now takes us over.

It's a fast 2-hour-40-minute run on the L & H from Maybrook to Phillipsburg, N.J., where the Pennsylvania Railroad will take us. *But we are about to do it in two hours flat.*

We make a quick engine change and go snorting out. Bill and I now are in an L & H caboose.

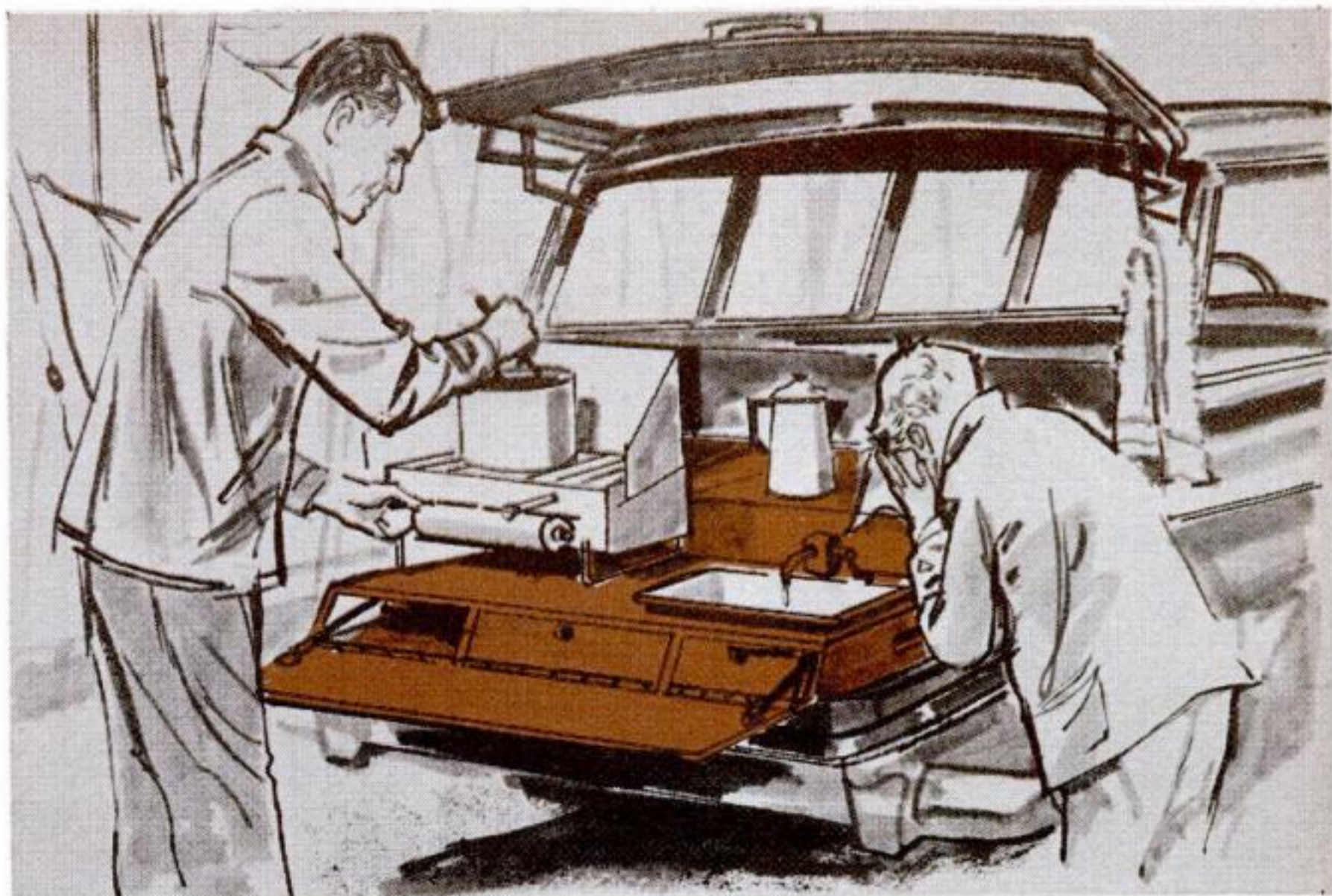
Our L & H engineer, whom we will never see, winds up the spring and we fly. Our partner in the new cabin (our third) is a lively flagman named Corky Shields.

1:10 a.m. The Jet is running like a scared ghost. The noise is deafening. Corky keeps spidering up top to have a look. Then he leaps down, turns up the oil lamp, and writes reports. Bill tries

[Continued on page 210]

New Ideas from the Inventors

.....



Tailgate Kitchen Fits on Wagon. Camp-out housekeeping in a station wagon may become almost as simple as in a trailer if this recently patented "kitchen" goes

to market. The compact unit—sink, stove, and storage drawers—would fit snugly at the rear for travel and slide out onto the tailgate for use at mealtime.

Spool Re-Inks Ribbon. Your typed letters would have a uniform appearance—never faded or too dark—if your ribbon re-inked itself in a spool reservoir like this. Ink would bleed from the hub onto a forked applicator of felt. As the ribbon wound through the applicator, it would pick up enough ink to replenish itself.

Serving Fork Frees Speared Food. With a thumb-operated ejector like this on the fork, you could serve your guests as adroitly as a continental waiter. Pushing the thumb button would move a channel-shaped slide along the tines to neatly disengage a speared slice of meat, a chop, or a slab of melon, as below.

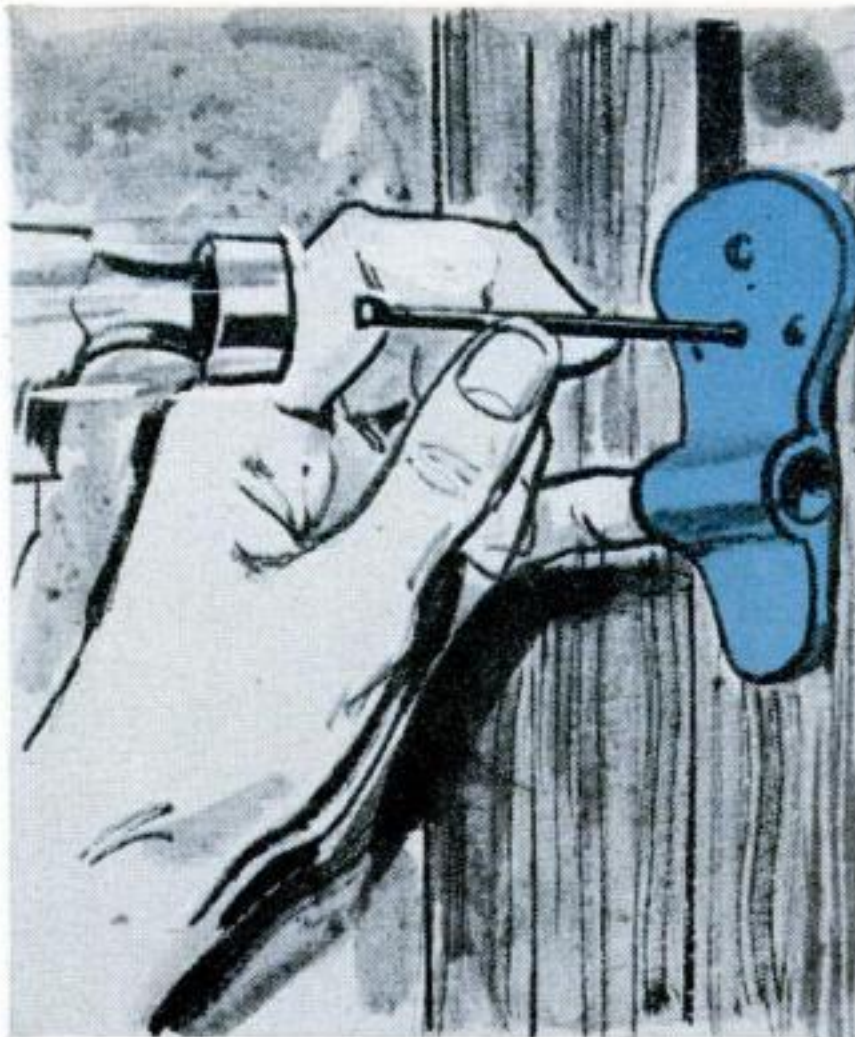


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More Inventors' Ideas



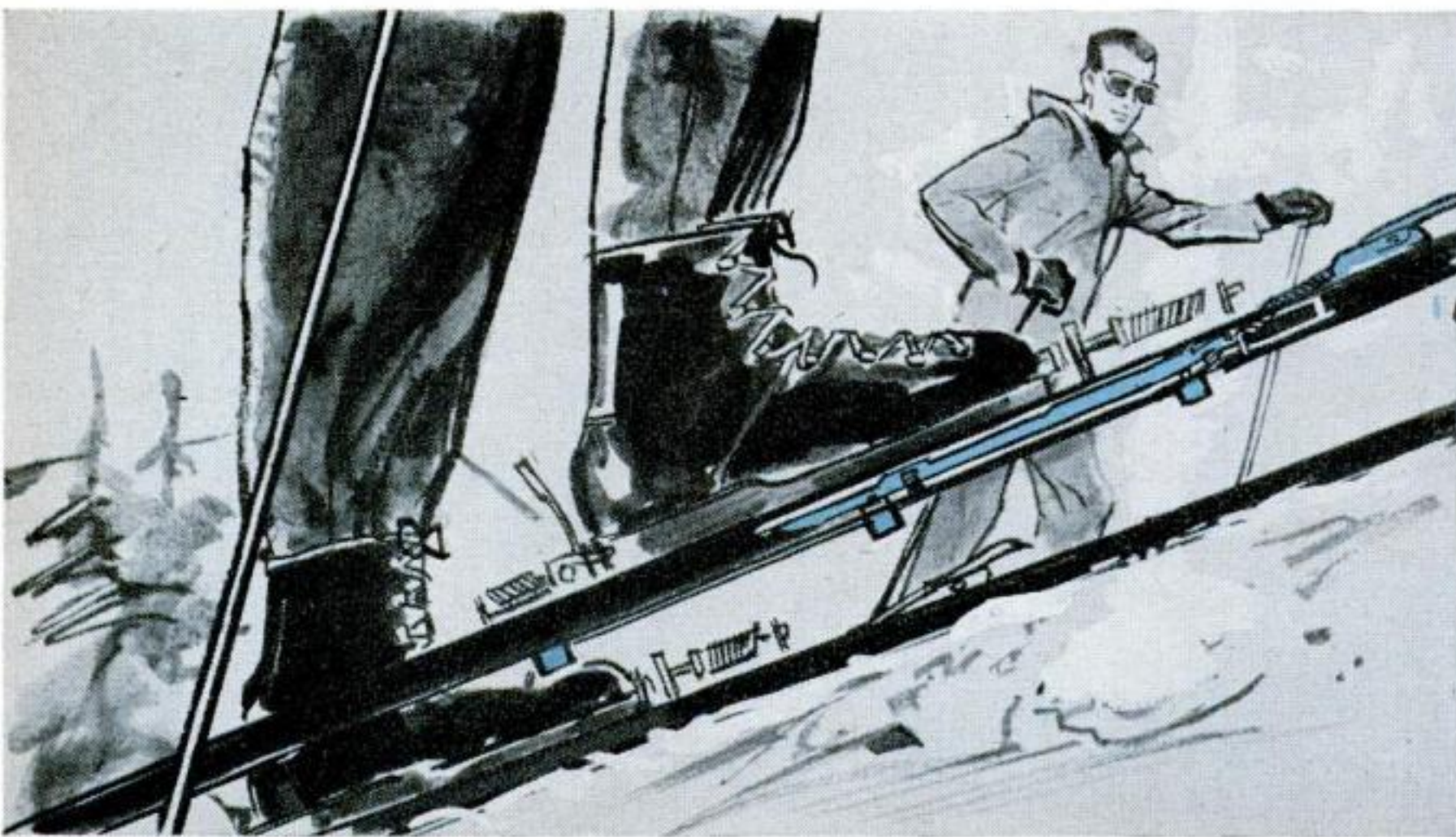
Strap-In Seats Tie Down Kids. Can't drive a car with shenanigans in the rear? You might be able to relax if the small fry were buckled into these raised, scenery-level safety seats. Three or more canvas seats would be supported between a rear-deck rod and another cross rod clamped to the doors, keeping them shut.

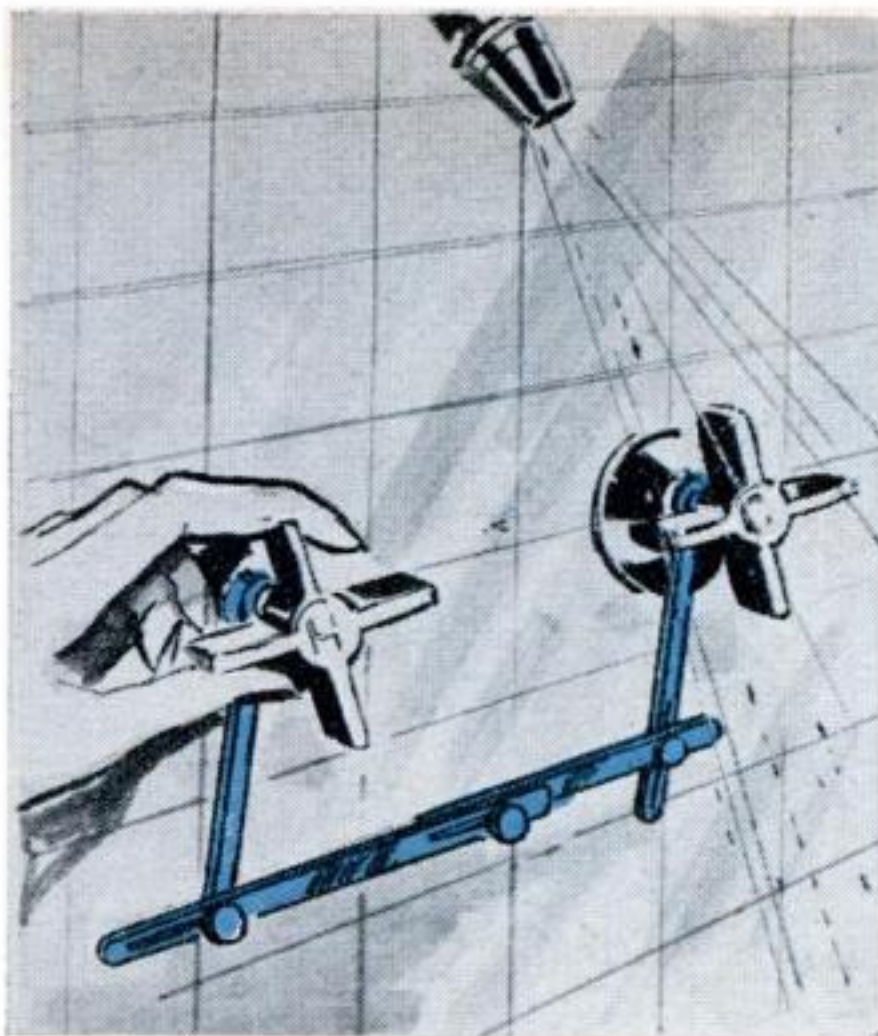


Guard Protects Woodwork. You'd never scar wood panels with hammer gouges if you drove finishing nails through a guard like this. Holes in the protective plate are designed to take nails of various sizes. You'd hold it with your little finger, as shown here, and a second nail could be popped into the hole to set the first.

Brake Helps Skier Climb. With a metal device like this attached to each runner, a skier could climb slopes and control descents more easily. Lugs, recessed

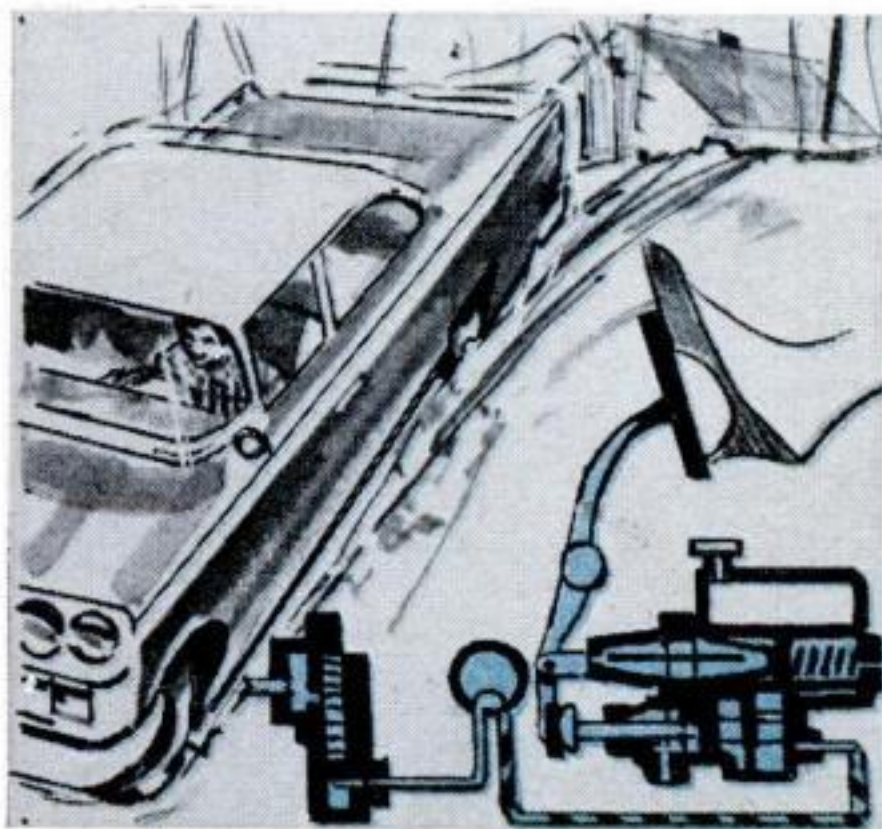
within the attachment, would pop out when a lever was pulled, to provide traction. With the lugs retracted, the skis would offer a smooth surface to snow.





Faucet Link Adjusts Mix. You'd get water just the temperature you like by turning only one tap if your faucets were linked like this. Collar-fastened to the hot- and cold-water faucets, the yoke would have a sliding connecting rod that could be preset to deliver a mixed flow at the temperature that you prefer.

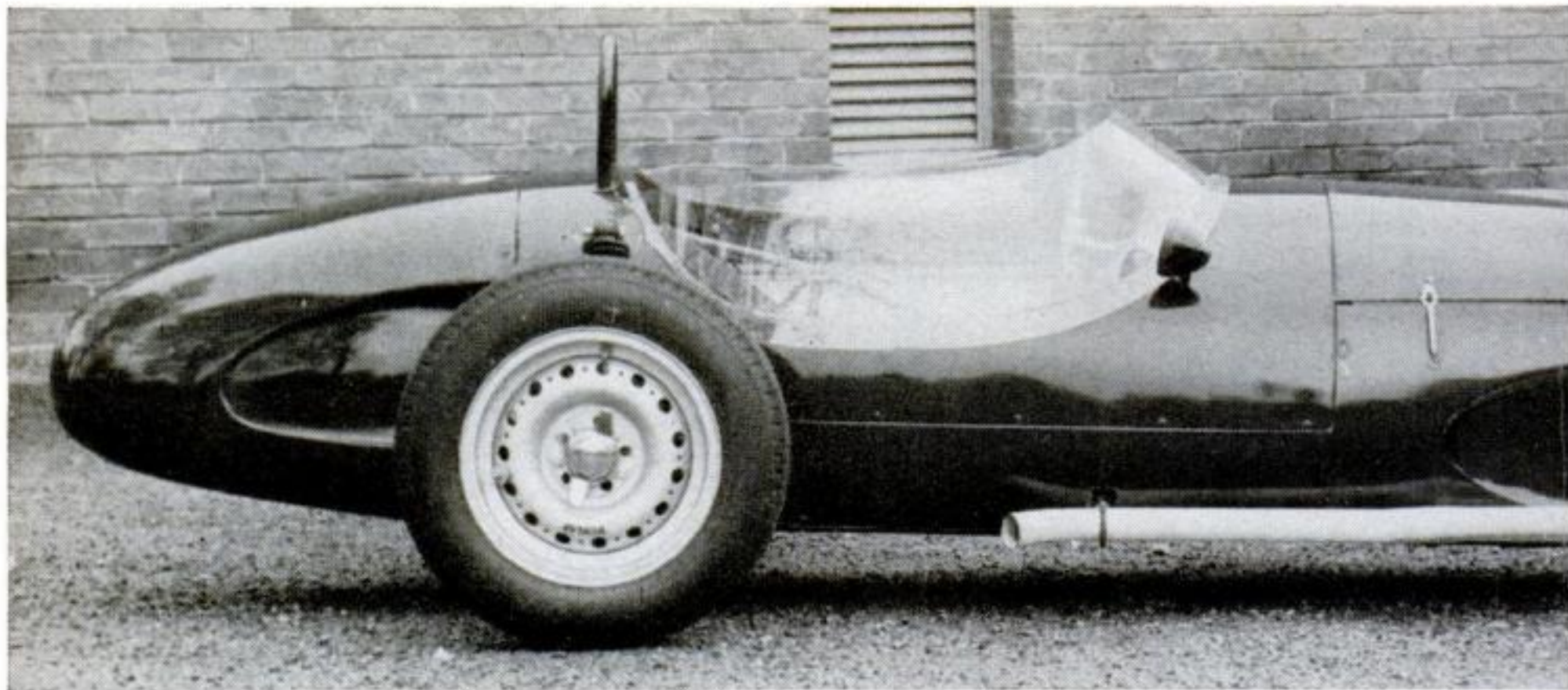
Pulse Brake Fights Skids. To counter slippery-road skids caused by hard braking, this safety brake would convert steady pressure on the pedal into rapid on-off application of the brakes. A pulsating piston in the brake line would be connected to the oil pump of the car. A driver-operated switch would bypass the pump for conventional braking action.



Hook Anchors Boat to Tree. An inshore hunter or fisherman could anchor a small boat for minimum drift with this hook. The boatman would manipulate a trigger and ratchet to clamp it tight around an overhead or submerged branch. A cord and pin would connect it to an oarlock.

The following patents have been issued on these inventions:
Wagon kitchen—No. 2,867,471 to A. Coon Jr., Pasadena, Calif.;
Re-inker—No. 2,869,706 to J. W. H. Bishop, Essex, Conn.;
Fork—No. 2,873,522 to R. Homola, Northampton, Pa.;
Car seats—No. 2,988,135 to A. Caminiti, 3824 Santiago, Tampa, Fla.;
Guard—No. 2,878,476 to D. Auchard, Anaheim, Calif.;
Ski brake—No. 2,844,380 to E. Tribelhorn, Vevey, Switzerland;
Faucet link—No. 2,872,829 to E. Belmont, Granada Hills, Calif.;
Car brake—No. 2,949,740 to B. Aikman, St. Petersburg, Fla.;
Anchor—No. 2,983,243 to J. Bowers and J. Logue Jr., Nashville, Tenn.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D. C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.



WHAT HAS THIS CAR GOT in common with a sedate medium-priced family sedan? The sleek,

open-wheeled racer is serving as a guinea pig for the revolutionary Ferguson passenger car.

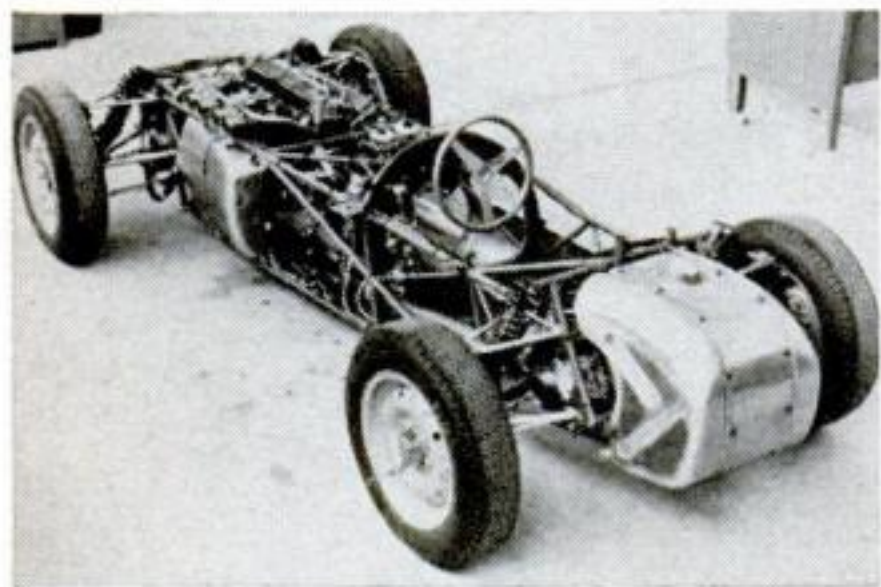
Racer is testbed for a new car

Safety features of the British Ferguson passenger car, scheduled for a 1963 debut, are being tested on a racing car.

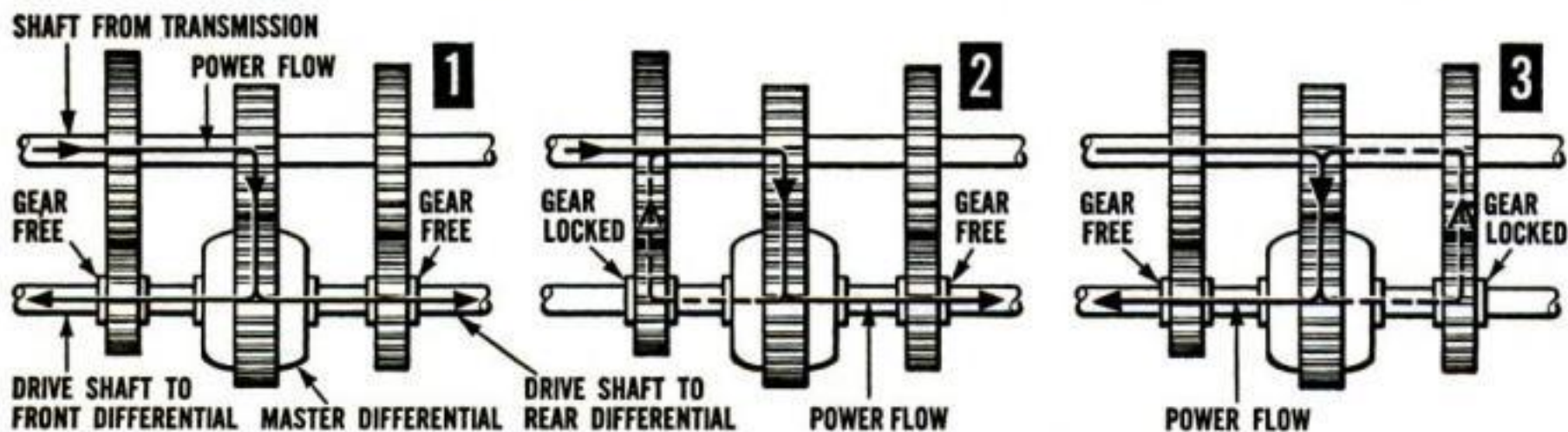
They include limited-slip four-wheel drive and skidless braking. For maximum

traction, a master differential divides engine torque evenly among four wheels. The engine is coupled to front and rear differentials through this bevel-type differential and also through individual spur gears on two drive shafts. These pairs of gears have a slightly different ratio from that of the final drive. Each secondary gear has a free-wheel in its hub to prevent jamming from the conflicting ratios. When a road wheel spins, the drive shaft to its differential is checked by the free-wheel, which then locks that shaft to the gearbox output.

The Dunlop Maxaret system, already used on aircraft, consists of an inboard disk brake on each independently sprung wheel. To equalize braking if any wheel slows more than the others, a flywheel-actuated valve in the hydraulic circuit automatically releases that brake.

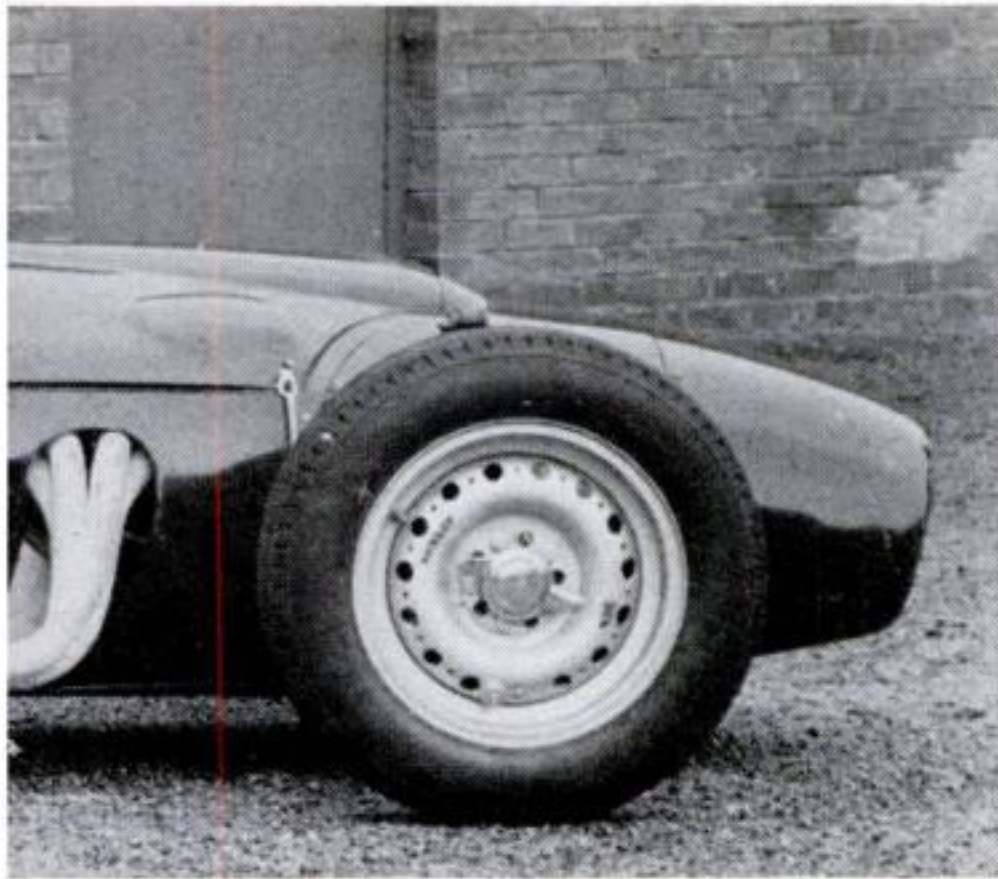


Naked chassis reveals its rugged space frame.

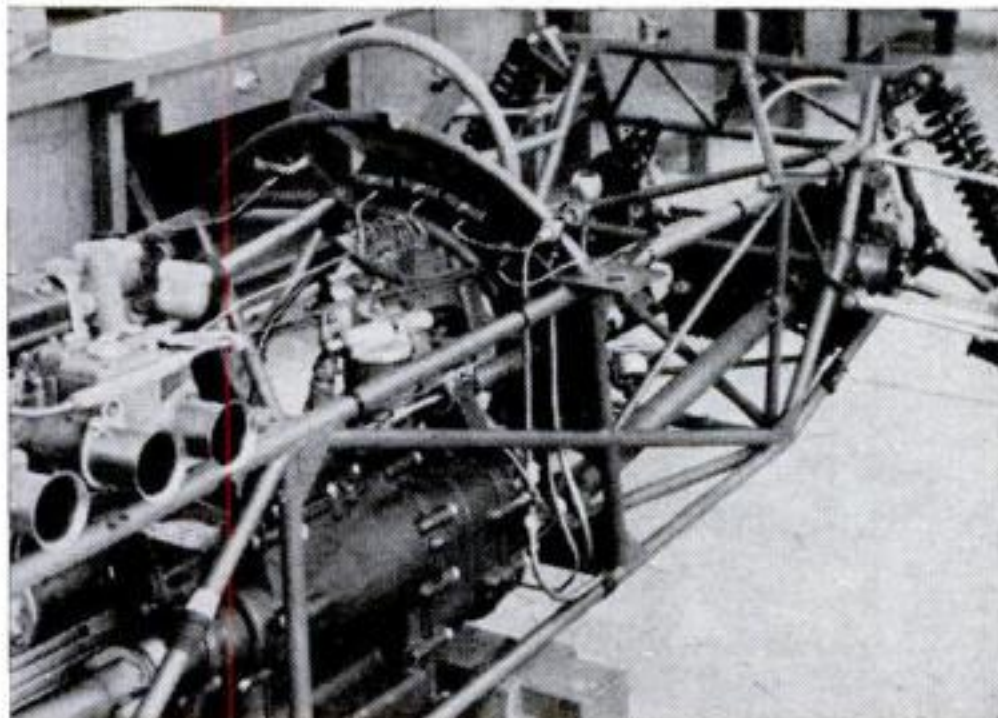


HOW POWER FLOWS: All four wheels run free in diagram 1. Diagram 2 shows front wheels spinning or rear wheels approaching lock because of poor traction. The front drive shaft is

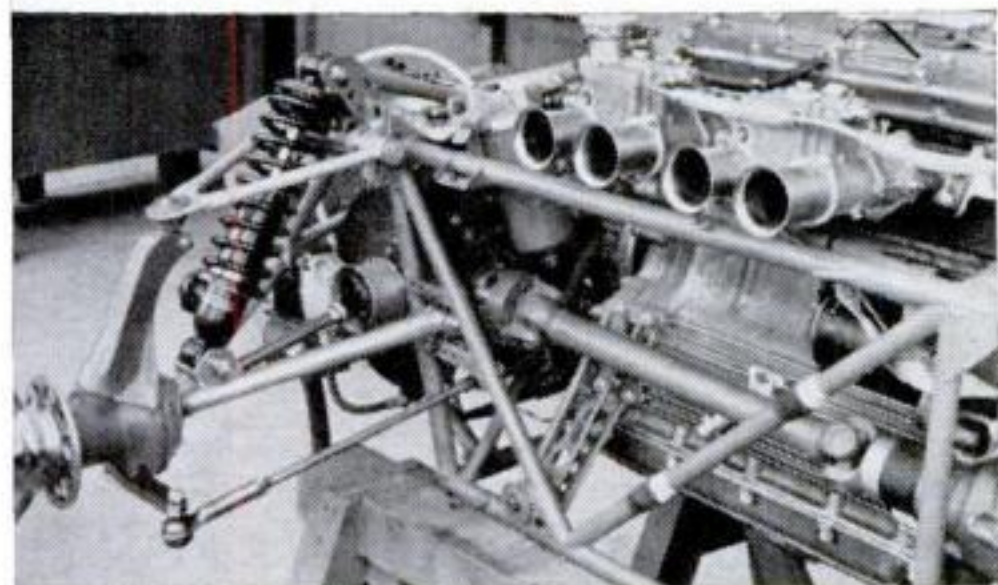
immediately slowed by being locked by a secondary gear to the gearbox output shaft; torque to the rear wheels consequently is increased. In diagram 3, opposite takes place.



It's one of many cars used by engineers plugging away to produce a skidproof car.



FIVE-SPEED TRANSMISSION combined with master differential is shown here. This setup provides superior traction during all-out acceleration as well as in high-speed cornering.



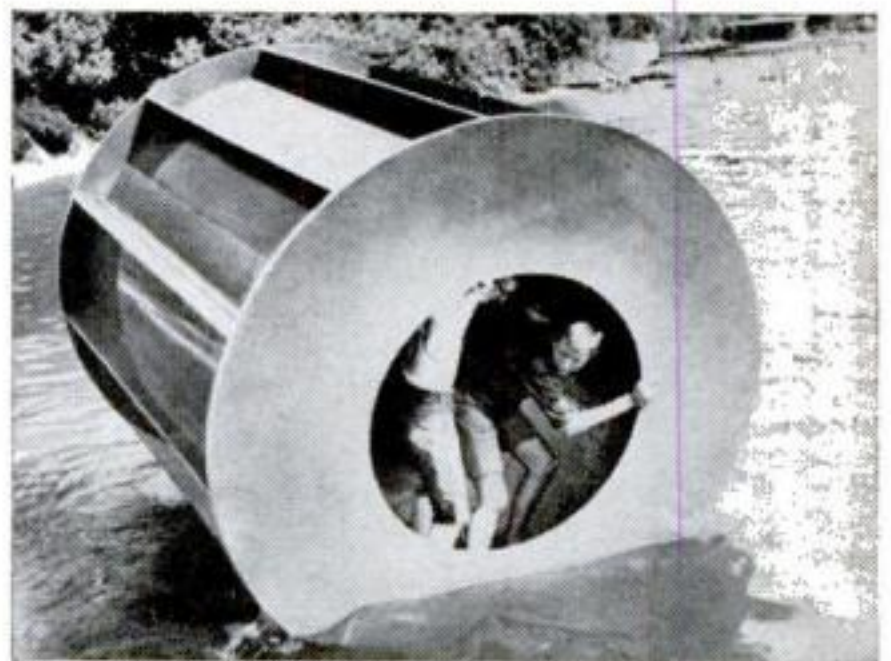
VALVE IN BRAKING SYSTEM relieves hydraulic pressure and bleeds off fluid before wheel can lock. Racer's 152.5-cu.-in. Coventry Climax engine develops 239 hp. at 6,750 r.p.m.



"Tank" tows paint roller

A miniature army tank with a paint roller in tow is being developed by Esso Research and Engineering Co. to cut the cost of painting ships and oil-storage tanks. Magnets set in the rubber treads of the toy tank being tested above cling to the metal surface.

An operational robot painter would be about 3 feet long and 1½ feet wide. There'd be a chipper at front to prepare the surface; behind, a pressurized roller would feed paint from a reservoir inside the tank. Pneumatic ground controls would drive an air turbine in the treads at a rate of half a foot a second.



Squirrel-cage barrel boat

Walking inside up the sides of this barrel-shaped plywood boat rotates its paddle-wheel vanes and sends it churning through the water—at a maximum speed of three knots with a full crew of four. It was built by Dan Grinstead on Mercer Island, Wash., and so far has proved seaworthy on Lake Washington.

Flat- Footed Tires Tread Softly



NEW SWAMP-CONQUERING TIRES keep oil-exploration vehicles from bogging down in marshes, allow crews to resume work immediately after heavy rains that used to immobilize their trucks.

ONE-AND-A-HALF-TON wheels that exert little more ground pressure than a man's footstep are now helping to move Army cargo over Alaskan snows. The tires, which measure nearly 10 feet in diameter, are one of the latest additions to Goodyear's growing line of go-anywhere flotation tires.

Flotation tires—Goodyear calls them "Terra-Tires"—have two characteristics that adapt them for scores of unlikely jobs: They are nearly as wide as they are high; and they are designed for extremely low inflation pressures. Some ride

on as little as one pound of air. This means, among other things, they won't sink into a surface strong enough to support even a couple of pounds of weight per square inch.

In addition to coddling the ground, some low-pressure tires can actually float their vehicles over water. Others, used for example in pecan harvesting, can ride over nut-strewn fields without cracking fragile shells.

In these tires, low pressure is combined with a big footprint that provides traction on sand, snow, and marshland.

You can now buy—or build—go-anywhere carts

PROSPECTORS, explorers, and sportsmen who travel beyond the end of the road can now ride in comfort in this new 1-cylinder "Rat." The 20-m.p.h. cart, made by Remote Area Transportation Corp., has four 15-inch-wide, 16-inch-diameter tires that can be pressured at 2 to 5 pounds depending on terrain.



NEWEST and lowest-cost version of a flat-footed two-seater that will carry you comfortably over mud, rocks, beach, or desert sand—or even over the snow—is shown at right.

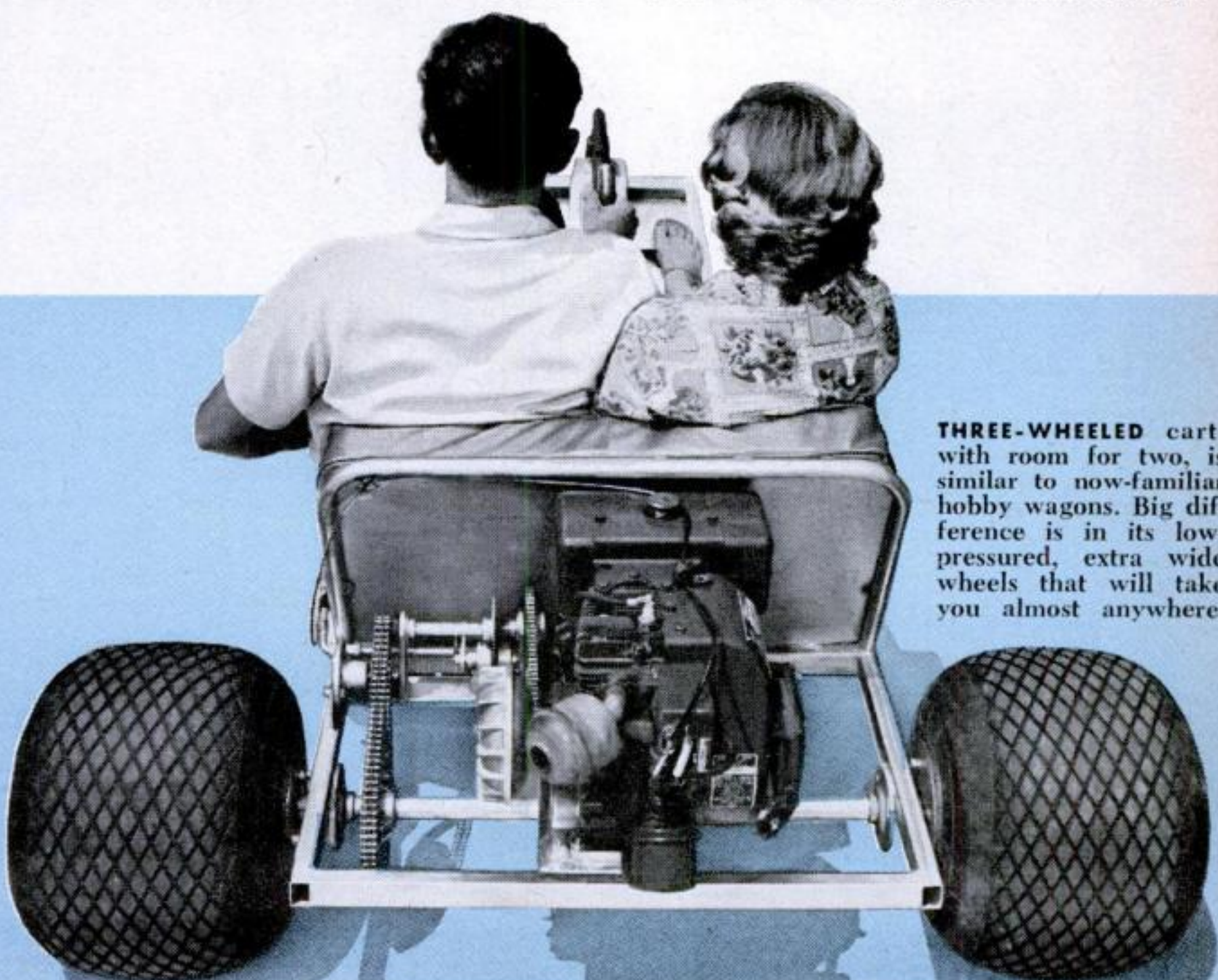
It's a prototype of a three-wheeler that will soon be available to sportsmen, explorers, and off-the-road travelers in a factory-assembled model.

This strange-looking buggy was designed and built by V. Lee Oertle for an article on how you can build your own go-anywhere wagon with standard kart parts. Look for complete plans and construction details that will appear next month in **POPULAR SCIENCE**.



FOR NO-RUT RAKING of the turf, Hollywood Park race track now uses 42-inch-wide tires

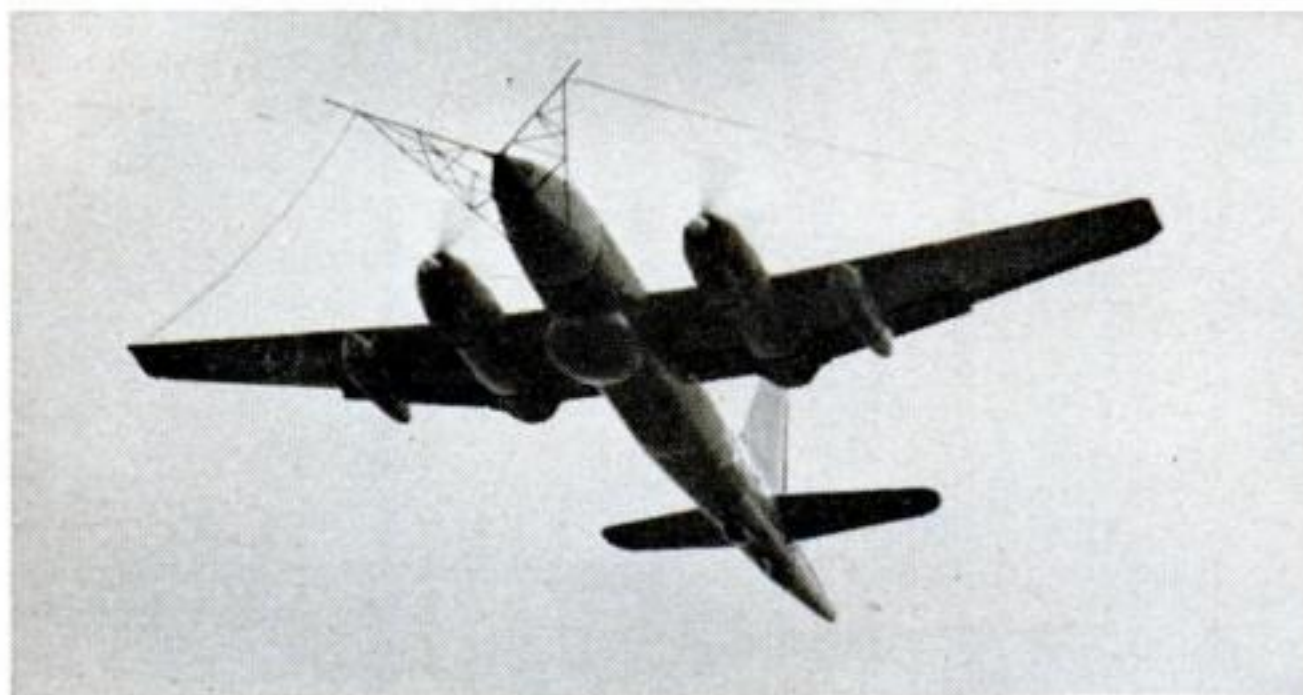
on this drag tractor. The 5-pound-pressure tires have a footprint lighter than a pony's.



THREE-WHEELED cart, with room for two, is similar to now-familiar hobby wagons. Big difference is in its low-pressured, extra wide wheels that will take you almost anywhere.

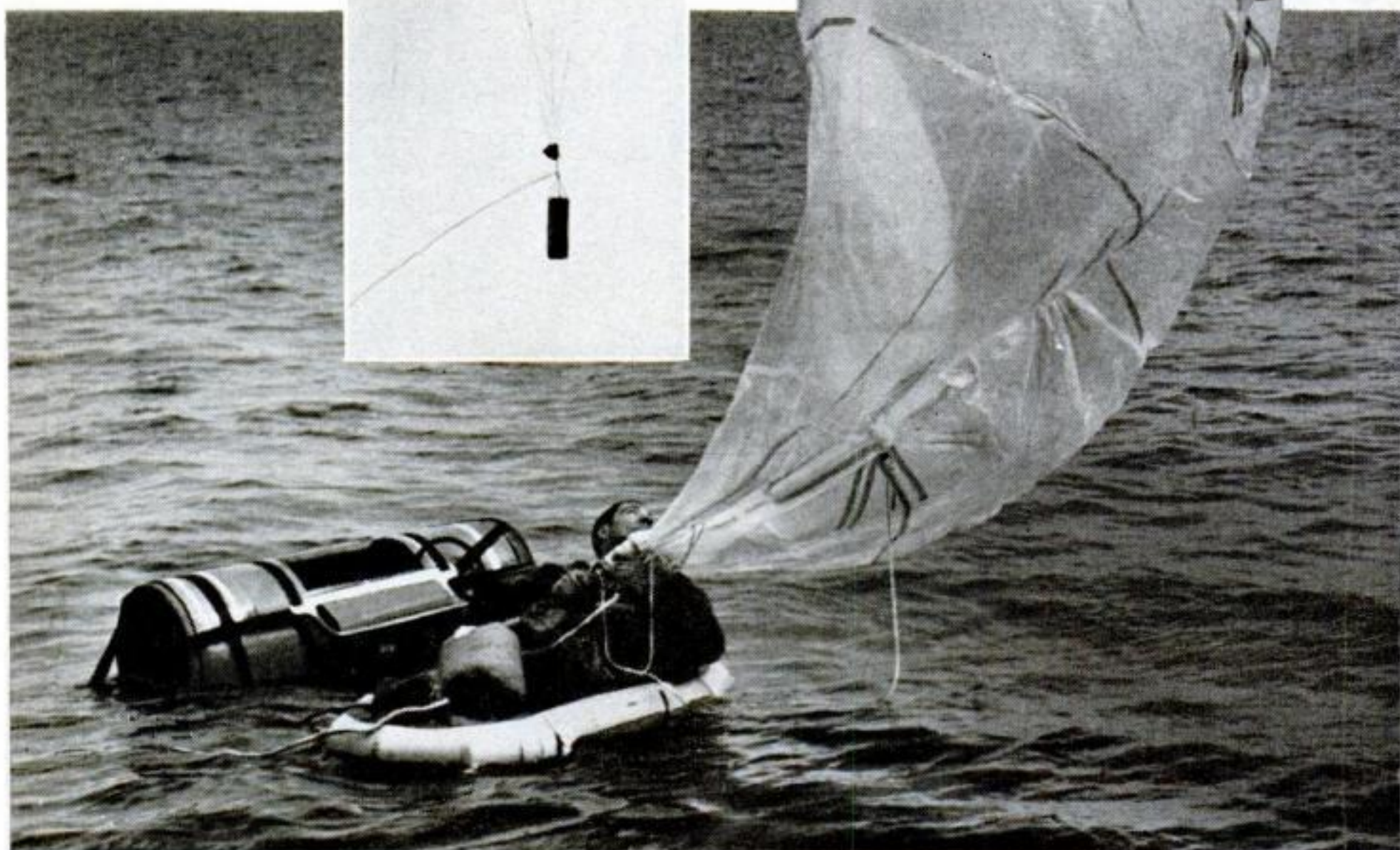
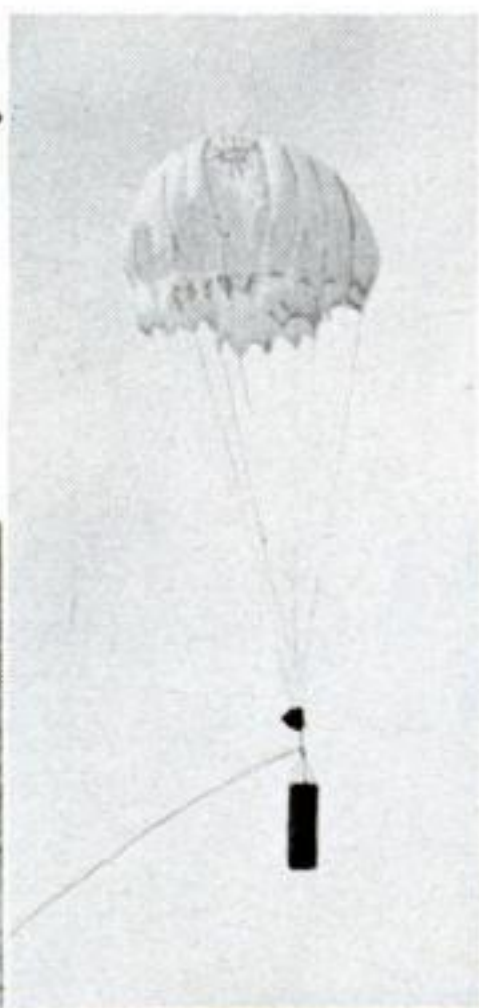
Skyhook Plucks Pilot Out of Trouble

By Eliot Tozer



1 V-SHAPED YOKE on nose of P2V has secret device in crotch for snagging nylon lift line and hauling downed pilot out of raft at high airplane speeds. System is called Skyhook.

2 IT'S IN THE CAN—► rescue suit, lift line, and balloon to raise lift line to 500 feet are all dropped in four-foot-long floating container.




THE crew of a Navy P2V patrol bomber spotted a blimp-shaped balloon floating lazily above Chesapeake Bay. Five hundred feet below it, bobbing on a raft, was Chief Mineman James H. McGee. A thin nylon line ran from a harness on his back to the balloon.


Maintaining a 150-m.p.h. air speed, the bomber flew straight into the nylon line, snagged it, and reeled McGee up into the bomb bay like a very valuable fish. Its catch aboard, the bomber nosed down over a circle of Navy brass in a nearby

field. There—just to show how good it was at this serious new game—it gently plucked Lt. Edmund P. Jacobs from their midst and reeled him aboard, bagging its limit for the day.

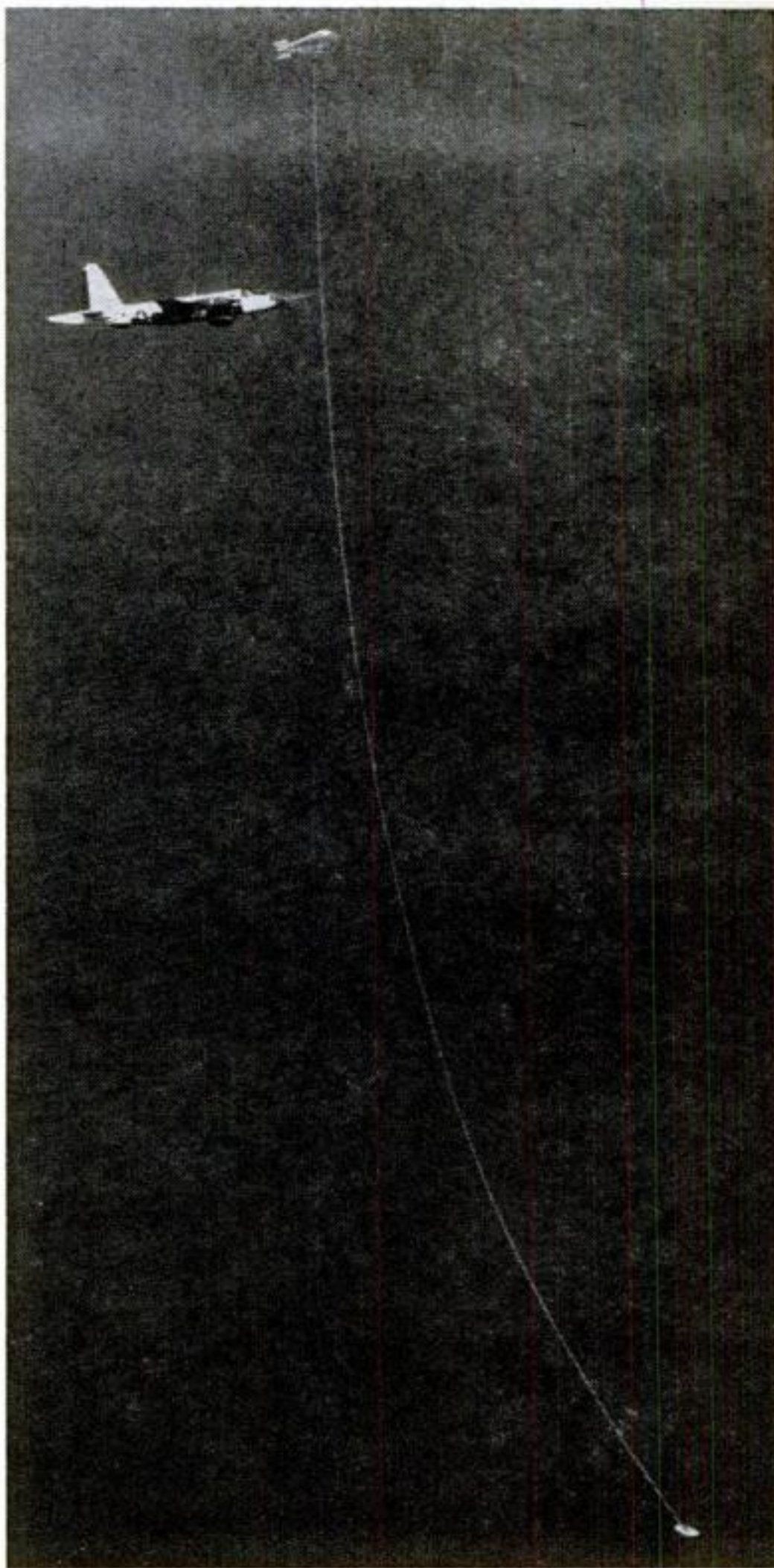
The P2V crew could have plucked the two volunteers off an ice floe, from desert sands, or out of a narrow forest clearing. For Skyhook, as the system is called, will work practically anywhere. By a quirk of geometry, the load starts almost straight up and then arcs toward the plane in a gentle curve.



3 BLIMPLIKE BALLOON is filled with helium from two high-pressure bottles in the dropped container. The downed airman slips into special rescue suit, attaches lift line to his harness, and releases balloon.



4 PLANE WITH YOKE always makes approach upwind at an altitude of about 500 feet, flies straight into the nylon lift line, and snags it in the yoke.





5 AND A-W-A-A-Y WE GO. Airman rides upward comfortably in his rescue suit. Jolt is less than he'd get in a parachute jump.

The rescue plane makes contact at 150 m.p.h.—speed is necessary behind enemy lines—but contact shock is less than the jolt of an opening parachute. Acceleration from zero to airplane speed is so gradual that the first man picked up by Skyhook, Marine Sgt. L. W. Woods, was able to take off his flight gloves, adjust his chin strap, and pull his gloves back on during the reel-in.

Round-trip travel. In a way the device completes a cycle: With the parachute, a guy can go anywhere; with Skyhook, he can get out again.

It's one of those why-didn't-I-think-of-that inventions. In the words of its inventor, Robert Edison Fulton (kin to the steamboat designer and named after Thomas A. Edison), "Skyhook is a 'natural.' It follows the laws of nature." Yet seven years elapsed between the time the Office of Naval Research gave out the requirements for a long-range,



6 RIDING THE SKYHOOK is like a ride in a fast elevator. In about six minutes the rescuee is winched upward to plane where crew

high-speed aerial recovery system and the final acceptance tests this summer.

Fulton is a full-time inventor with a 15-man shop at the end of a country lane in Newtown, Conn. He built the Gunairstructor—a gunnery trainer for pilots—and sold the Navy \$6,000,000 worth during World War II. He also designed and built one of the first roadable airplanes, the Airphibian.

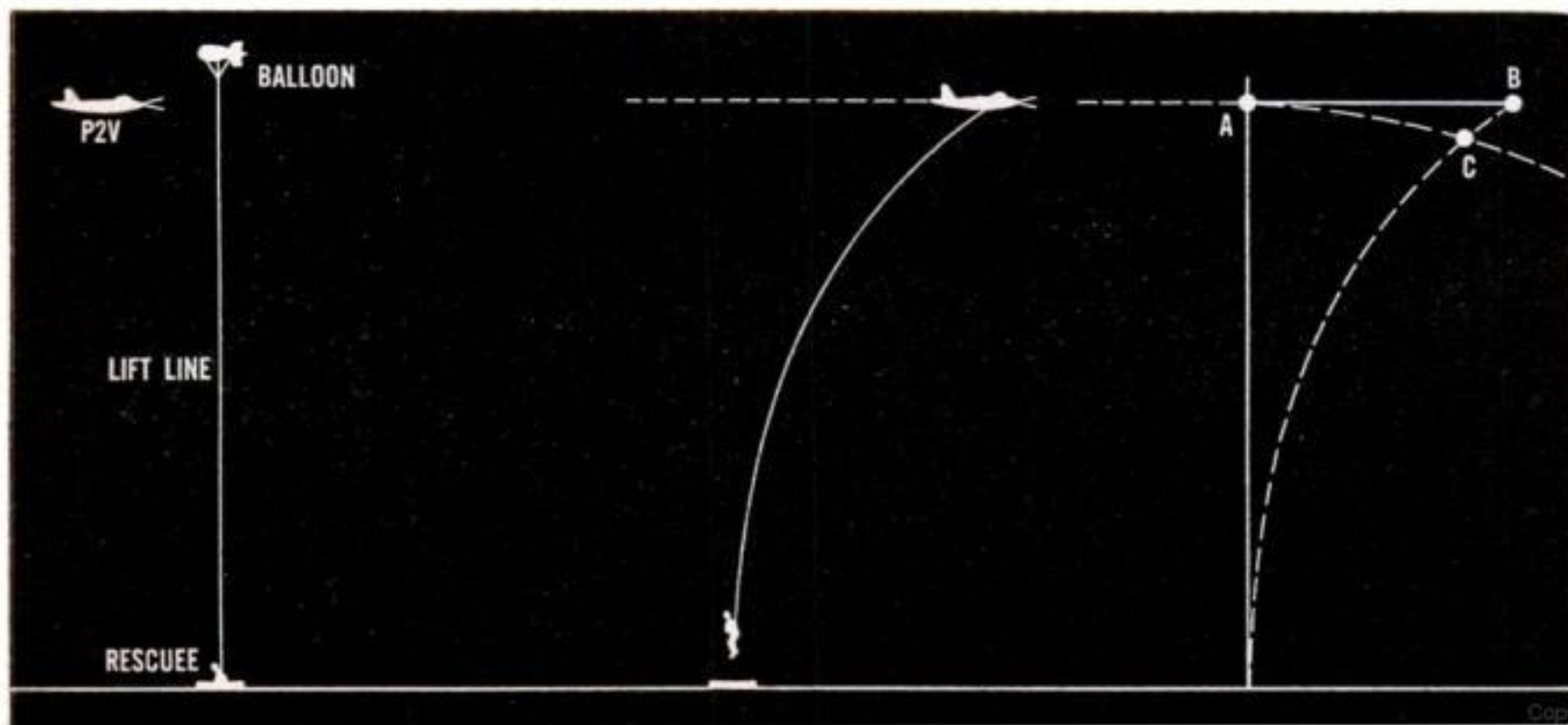
By Fulton's definition, an inventor adapts known principles to the achievement of new ends—and that is precisely what Fulton has done in Skyhook. Here's how it works:

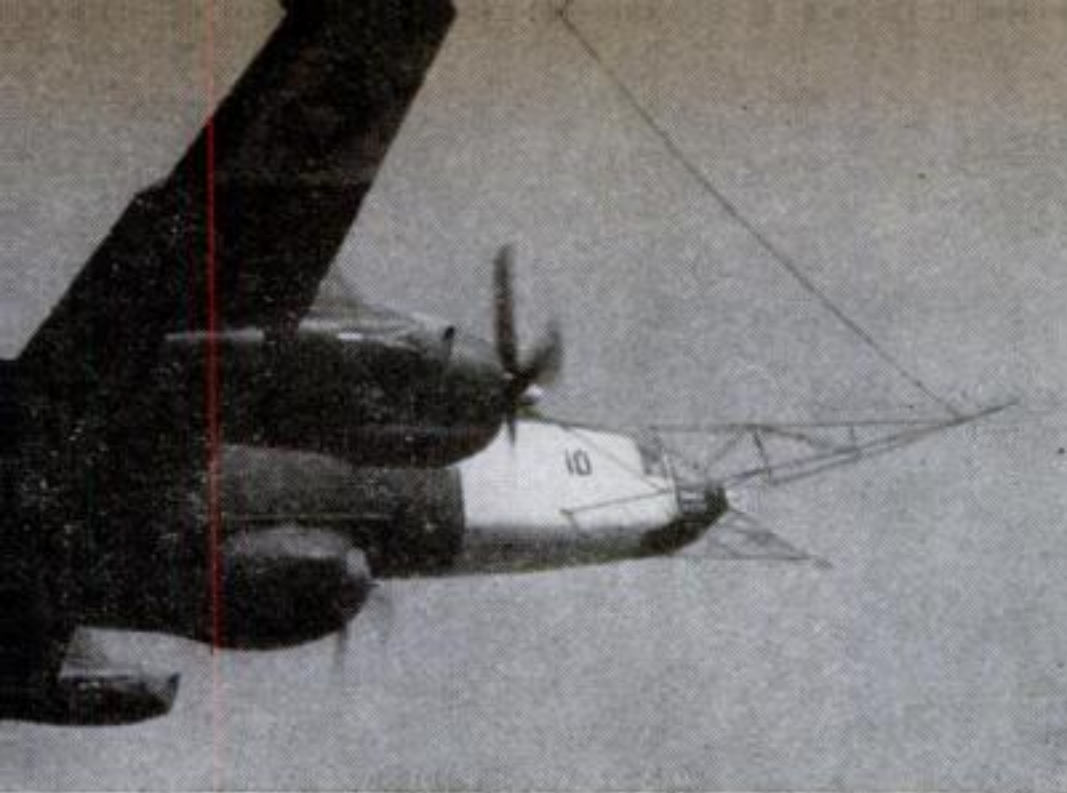
A fighter pilot bails out. Down on the Gulf of Alaska, he's beyond the range of any copter. Fast recovery is a must. So a long-range rescue plane fitted with Skyhook roars in over him at 300 feet and drops a four-foot container. A parachute blossoms and the container drops on the downwind side of the pilot—where

RESCUE PLANE approaches balloon at 150 m.p.h. Yet snagged rescuee goes straight up.

GEOMETRY IS KEY to success of the Skyhook. Rescuee follows parabolic curve to plane.

WHILE PLANE FLIES from A to B, rescuee travels—in effect—only from points C to B.





reaches out with a J hook and hauls him aboard like a valuable fish. Balloon breaks on contact and drifts away. Navy ordered Skyhook.

he can drift to it on his life raft. (There's a raft in the container if he needs it.)

At the same time, a 400-foot "float line" pays out. An obvious solution to a nagging problem—so obvious that no one had thought of it before—the float line is one of the Fulton touches that makes Skyhook a success. Fully payed out, it floats on the water surface and gives the downed man a 400-foot-wide target to paddle to rather than just the four-foot container. For desert or ice-floe rescues, the float line is not needed.

At the container, the pilot pulls out three bags, each plainly marked with a large Roman numeral. In the first is a rescue suit much like a standard flight suit. But through it is threaded a seat-type harness that automatically pulls up snugly on the shortest and fattest or tallest and skinniest man. Pulling on the rescue suit is easy. The pilot slips in, zips up the front, and closes one "horse buckle" across his chest.

In Bag II is the balloon. To inflate it, the downed pilot simply pulls a safety pin and squeezes a pair of handles. Helium in two bottles wound with fiber-glass inflates it in about four minutes to a 20-foot blimp.

Fulton chose the shape because an anchored blimp points her nose smartly upwind in gusty breezes and holds it there with minimum excursion. Like a kite, the balloon climbs higher the harder the wind blows, holding the lift line more nearly vertical.

I'll-do-it-my-way Yankee. Fulton used to buy standard, appendix-filler balloons. The "experts" told him, "You can't hold



7 "LET'S DO IT AGAIN" were the first words of Marine Sgt. L. W. Woods (shown here at conclusion of the first Skyhook test).

the balloon by the appendix [inflating tube] while you fill it; it will tear." Fulton knew that a downed pilot would grab at the nearest handhold—the appendix—so he cut it off.

The "experts" said, "You can't fill the balloon through the nose." But Fulton does.

And they said, "It takes an expert to fill a balloon to the correct volume." But Fulton knew his Skyhook might be used by a groggy or delirious pilot, so he devised a neat way to tell when the balloon is inflated to its normal 600 cubic feet: Two arrowheads ride in tracks on the nose just above the filler cap; when they meet, the balloon is full.

Today, he makes his own balloons.

Finally, with one end of the lift line (inside Bag III) attached to the balloon and the other buckled to his rescue suit, the pilot lets the balloon go and faces downwind, toward the oncoming plane.

Fulton has made or watched more than 500 pickups with Skyhook. Nine men, a score of animals, and dozens of instrumented payloads weighing up to 500 pounds have been successfully hauled aboard nine different kinds of aircraft. Yet he always gets a tickle of pleasure out of watching the load scoot up and ascend its parabolic curve toward the airplane.

Up and over. In early tests, Fulton took movies of the lift-off and projected them on a grid to find the actual path of the load. He was delighted to find that it climbs as much as 200 feet before it

[Continued on page 206]



Map Tops Student's Desk

An eight-color map of the United States, including insets of Alaska and Hawaii, is permanently laminated in the white Formica top of this new student's desk built on a 20-by-42-inch steel frame 29½ inches high.

Other features include a pivoted typewriter platform that swings out from under the top to convenient typing position and two roomy black drawers that contrast with the white frame finish.

The sturdy, modern map-top desk is priced at \$55. Sears, Roebuck & Co., 925 S. Homan Ave., Chicago.



GAS-PRESSURE REGULATOR is molded from nylon to eliminate cost of machining and lessen weight. You install Miser Mite (arrow) in a 2½-inch section cut from the car's gas line without adaptors or fittings. A calibrated steel spring reduces pressure from the fuel pump to 3½ pounds per square inch, saving on gas consumption. \$4.95. Milemaster, Inc., of America, Excelsior, Wis.

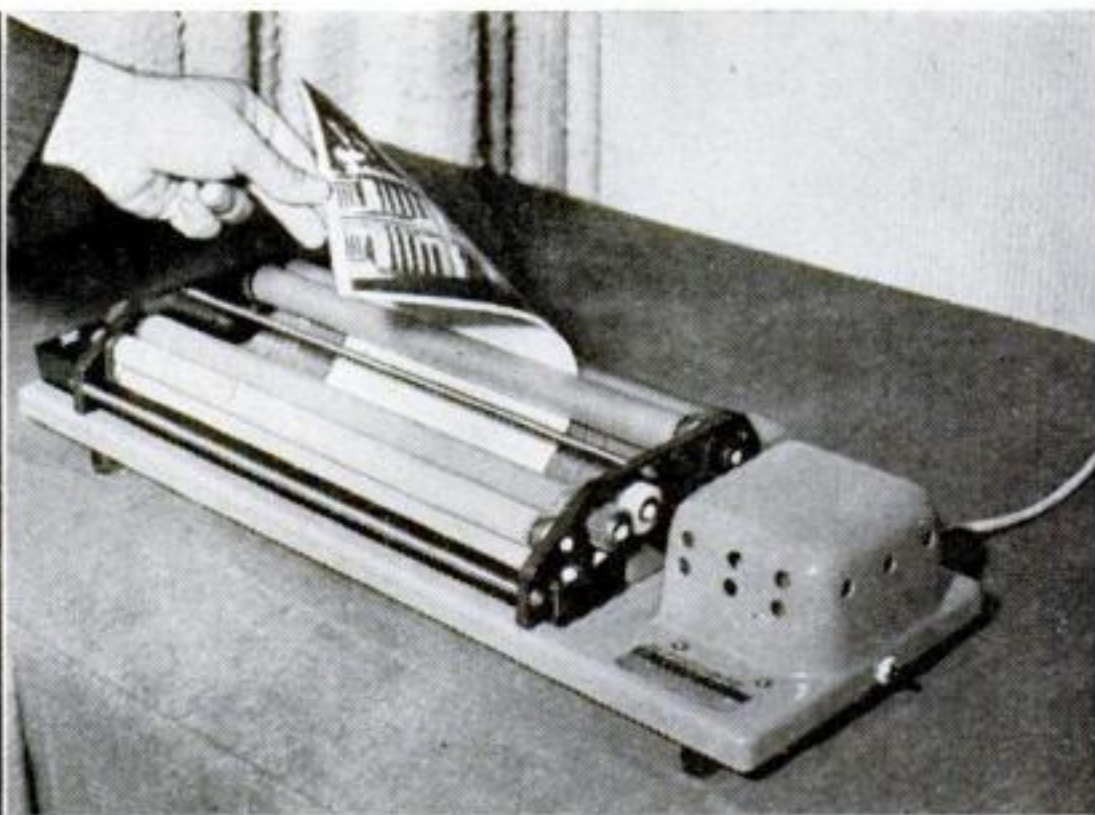
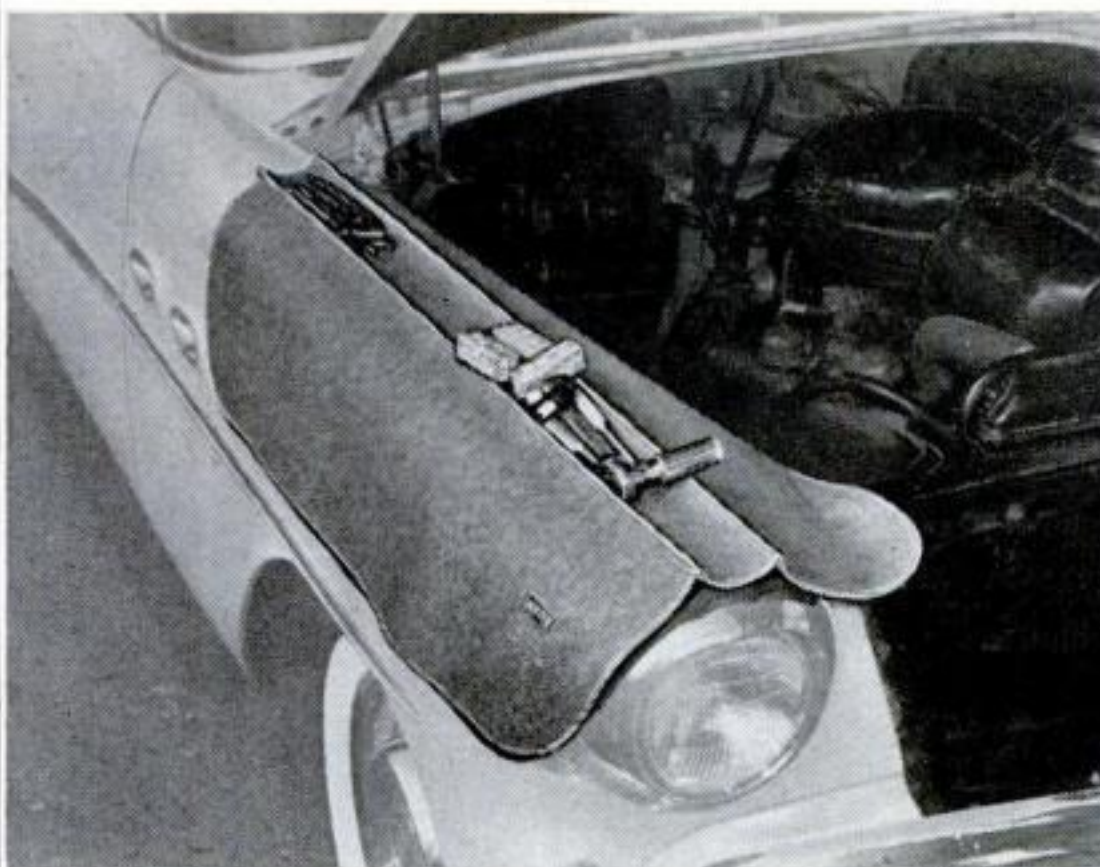


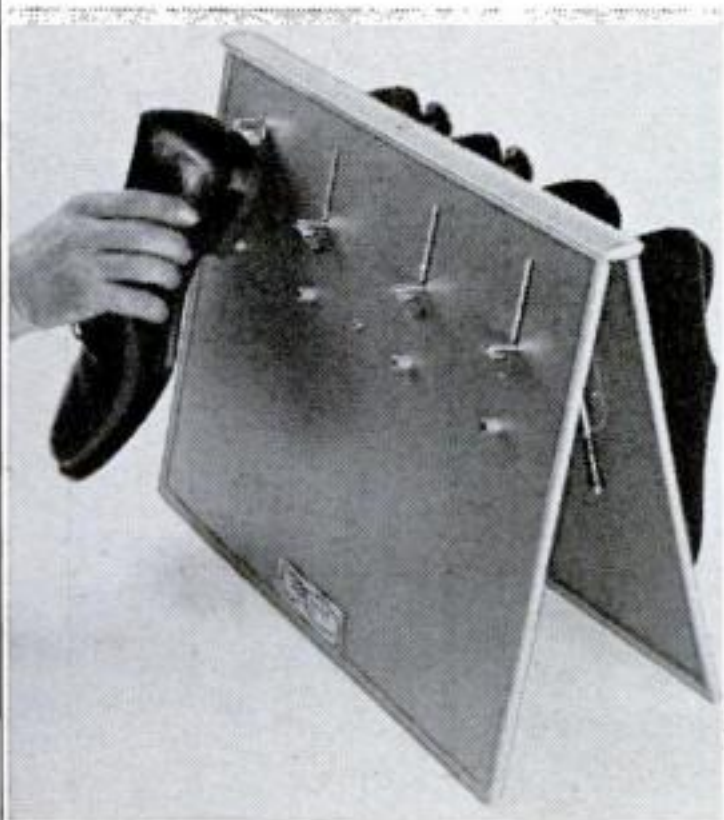
PHOTO PROCESSOR delivers permanent, semidry print in 15 seconds. Cover is removed here to show how motorized rollers move paper through developer and stabilizer. Special sensitized paper (available semimatte or glossy in many weights, sizes, colors, and contrasts) may be exposed in any enlarger or contact printer. About \$200. Fotorite, Inc., 6422 N. Western Ave., Chicago.



TROUGH IN FENDER COVER is formed by two $\frac{1}{2}$ -inch ridges sewn $4\frac{1}{2}$ inches apart to hold tools and small parts. It keeps you from having to reach into the toolbox when making repairs on car. Grip-Tex cover is a heavy, one-piece rubber mat that prevents denting or scratching while you work. Cost, \$5.95. Allen-Rick Co., 7925 Chase Ave., Los Angeles.



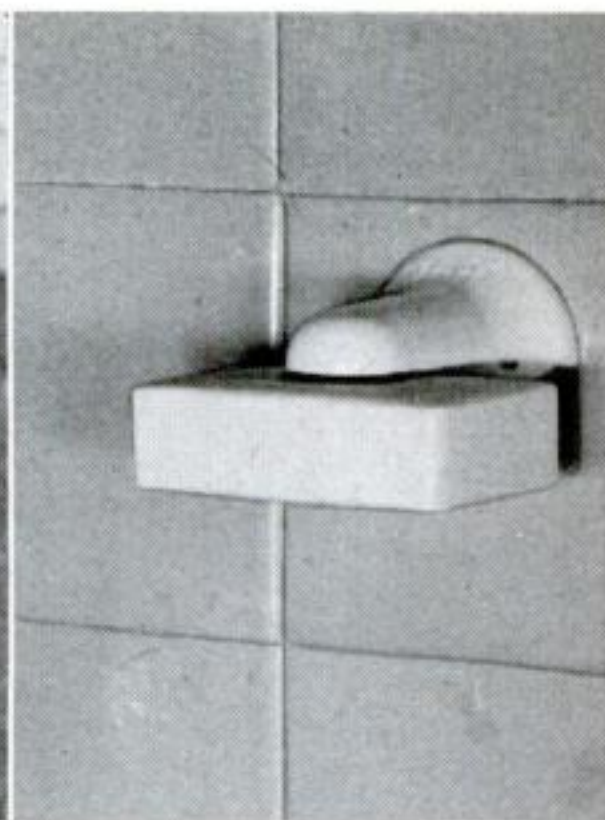
TREE IDENTIFIER consists of punched and notched cards with data on about 260 U. S. and Canadian trees. You insert a needle for a known characteristic on index side of stack, shake: all tree cards with that feature drop out. Repeat until the tree you want to identify is found. Tree-Sort sells for \$6. Sort-Card Co., Box 901, Boulder, Colo.



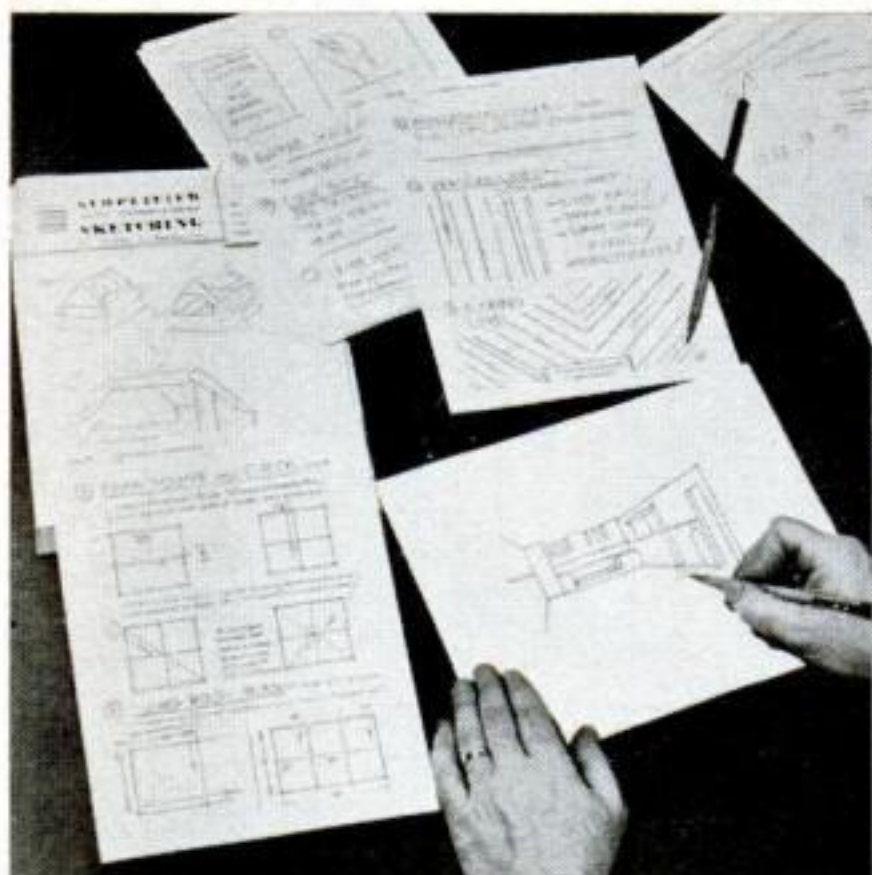
SHOE RACK clips four pairs of men's shoes by the heels. To insert, you push up top clip with shoe, let it spring back. Floor model is shown; wall model has twin panels you can screw to a closet door. \$4.95. Glido Mfg. Co., 17000 S. Western Ave., Gardena, Calif.



PAINT HOOK holds standard gallon bucket at side of ladder. It consists of stiff wire hook that fits over any rung, bent arm, and ring that you slip bucket through up to its handle anchors. It sells for 89 cents. Omar F. Hoelzel, 642 Park, Portsmouth, Va.



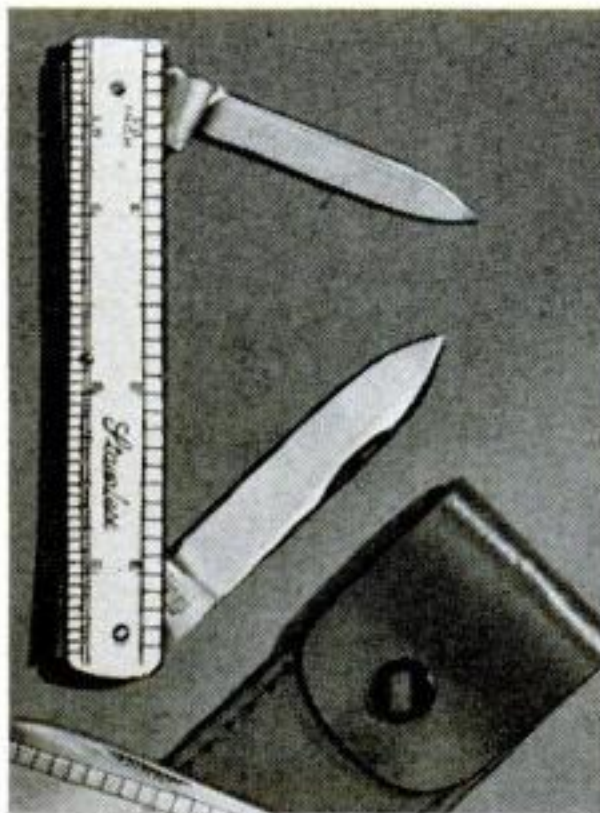
SOAP HANGER has magnet in plastic arm that clings to steel disk pressed into soap. You mount it on tile with special adhesive or screw it to wood or plaster. Rack comes in seven colors at \$1.25, or three for \$3. Bundy Sales Co., Mt. Tom Rd., Pawling, N. Y.



SKETCHING KIT helps you produce good freehand drawings so you can visualize projects you plan. It contains 20 instruction sheets that take you step by step from rudimentary line work through room layout and all phases of interior and exterior home remodeling. \$3. Nersica, Inc., 12 E. 41 St., NYC.



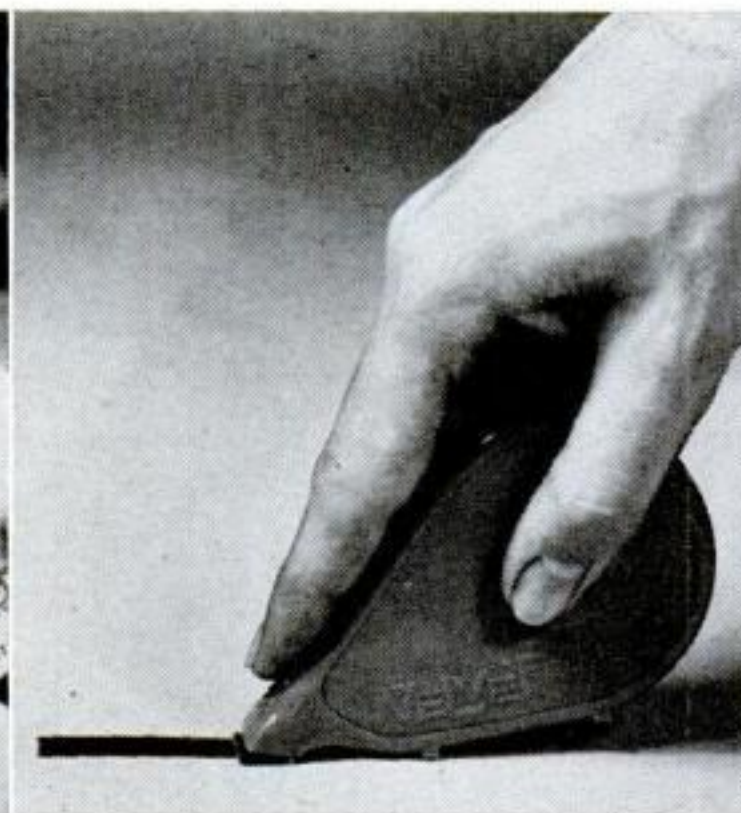
TWO-WAY RADIO can be switched from car to car or to home or office. It has a quick-rig holding bracket and simplified connections that make it easy to change installations in a few minutes. You use it on battery or household current. \$395. Outercom Electronics, Inc., 502 Charlottetown Mall, Charlotte, N. C.



POCKETKNIFE has 3½-inch rules engraved on its stainless-steel sides: scaled 1/10 and 1/16 inch on one, 1/64 and 1/2mm. on the other. Its two blades are Sheffield steel. \$2.95; leather case, 55 cents. Hamilton & Cleveland, 204 Canner St., New Haven, Conn.



SPRAY CLEANER is a softener and protector that removes oil-base paints from brushes and roller sleeves. You simply spray, let soak all day, then wash with soap and water. Hardened paint should be soaked longer. \$1.39. Stanley Tools, New Britain, Conn.



TAPE APPLICATOR lets you work with one hand. Press down, run tape along seam or around joint, tilt, and cut on toothed bar. It takes ½-inch-wide, 1-inch-core masking, vinyl, cellophane, or friction tape. 98 cents. Velvet Touch Corp., Bellingham, Wash.

Pole Hanger for Records

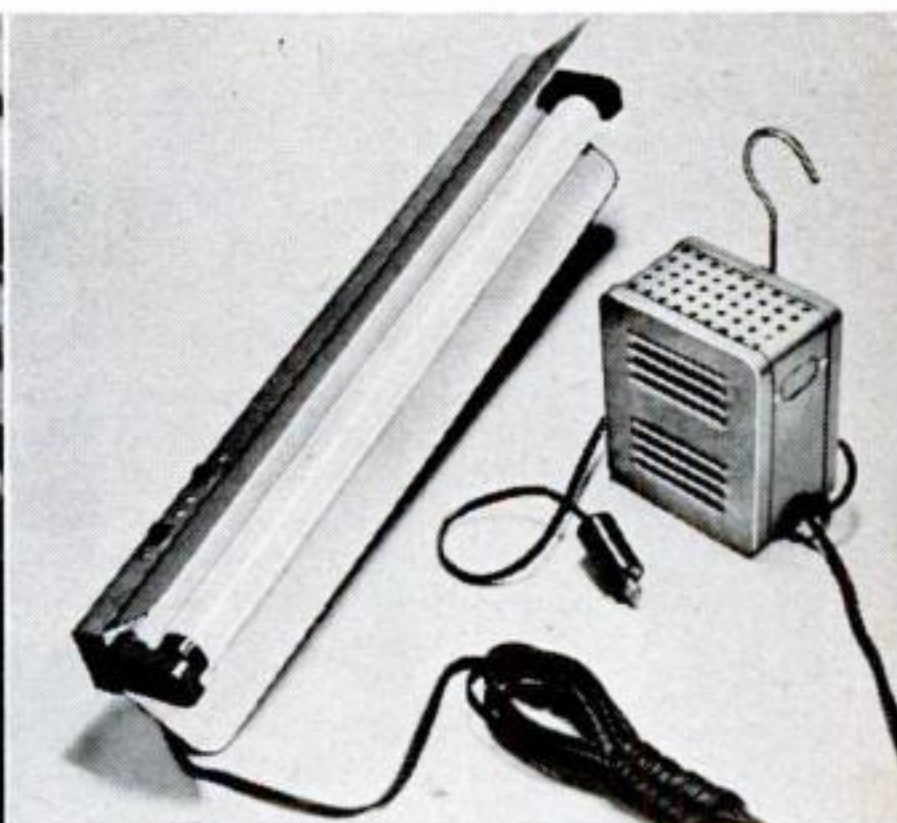
Tiers of 60 LP albums are stored and displayed on this brass-plated pole that adjusts from 4½ to 8½ feet to stand between ceiling and table top or floor.

Jackets slide between two grooved hangers and need not be removed when you want to take record out for playing. All albums in each tier can be rotated full circle for easy locating; individual hangers pivot 90 degrees.

Starter set: pole and one tier, sells for \$24.95; additional tiers for \$17.95. Record Tree, Inc., 214 S. 12 St., Philadelphia.



IGNITION CUTOUT is switch that disconnects battery from entire wiring system when you leave car unattended. You mount it on motor, and ground battery through it. Remote control is by stiff cable and knob in concealed spot under dash. Sampson safety switch also helps prevent battery drainage and is precaution in case of fire. It costs \$15.95. Franklin J. Scott, Farmington, Wash.

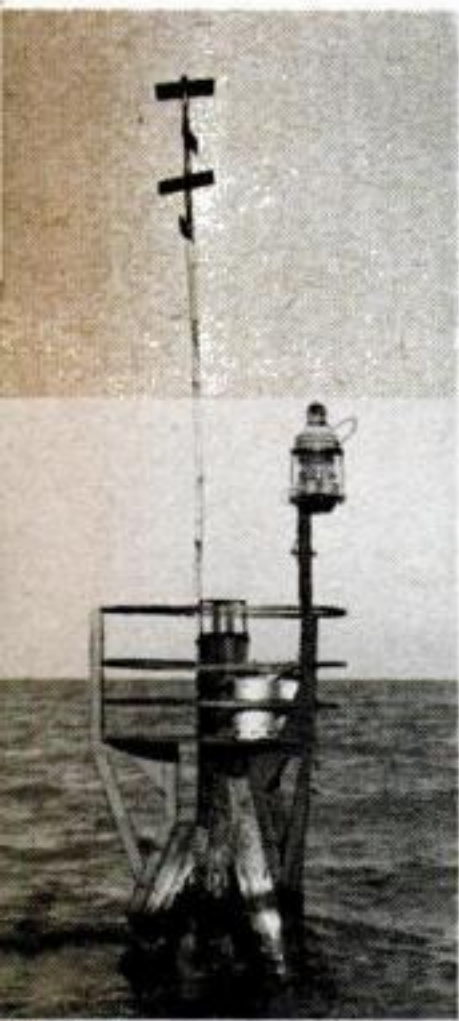


FLUORESCENT LAMP plugs into cigarette lighter on dash to provide bright, 18-inch trouble light when you need to work on your car or change a tire on the road. Operating through a power pack and 35-foot cord, it's useful for camping or to light a patio or boat dock. It won't work on household current. For either 6- or 12-volt batteries, \$14.95. Edmund Scientific Co., Barrington, N. J.



On wooden mud shoes, Eastern Flevoland's conquerors tread new land just wrested from sea.

Overcrowded Dutch Push Back Sea to Make Farmland



FROM OPEN WATER TO DRY LAND, photos show dramatic winning of newest part of Holland—Eastern Flevoland. In 1950 its principal community, Lelystad, was just a stake in middle of Lake Yssel (left). Dike, built around tract so it could be pumped dry, rose to 10-foot height above water (first photo in strip below) as pipe spouted sand fill between its parallel embankments. Today Lelystad is pioneer town on widened part of dike (second



Holland's bold Zuider Zee project is putting thriving settlements where nothing but fish and seaweed have existed in modern times

By David Scott

THREE billion Americans! That's the number there would be, if the U. S. had as many people to the square mile as the Netherlands—the most densely populated country in the world. And that's why crowded little Holland, for more living space, is wresting land from the sea.

Next year 150 Dutch farmers, in trucks laden with their families, animals, and furniture, will roll into a newly created part of their country. They are the vanguard of 100,000 colonists who will populate Eastern Flevoland—a place that isn't yet in the atlases because, until recently, boats sailed over it.

Winning this 133,000-acre territory has just given the Dutch their biggest victory in a spectacular campaign to dry up the Zuider Zee. Ultimately they'll have annexed five great tracts of former sea bed—they call them "polders"—totaling 850 square miles. The bold project is the greatest of its kind ever attempted anywhere.

Its dramatic story demonstrates a new style of territorial conquest—with the peaceful weapons of vision, determination, and engineering skill. By cutting off the Zuider Zee from the North Sea with an 18½-mile dam, in 1932, the

Dutch transformed that salty gulf into a fresh-water lake. They pushed back its water from 50,000-acre Wieringermeer Polder, and then from 119,000-acre Northeastern Polder—the first two tracts, which today are fully colonized.

Now, homes and barns for coming settlers are rising at the rate of one a day on Eastern Flevoland, the latest and largest tract so far drained—where I



PREVIEW of how Eastern Flevoland will look when colonized is given by views of a home (above) and farms (below) on land that once was at bottom of Zuider Zee, in prewar Northeastern Polder—last preceding one drained.

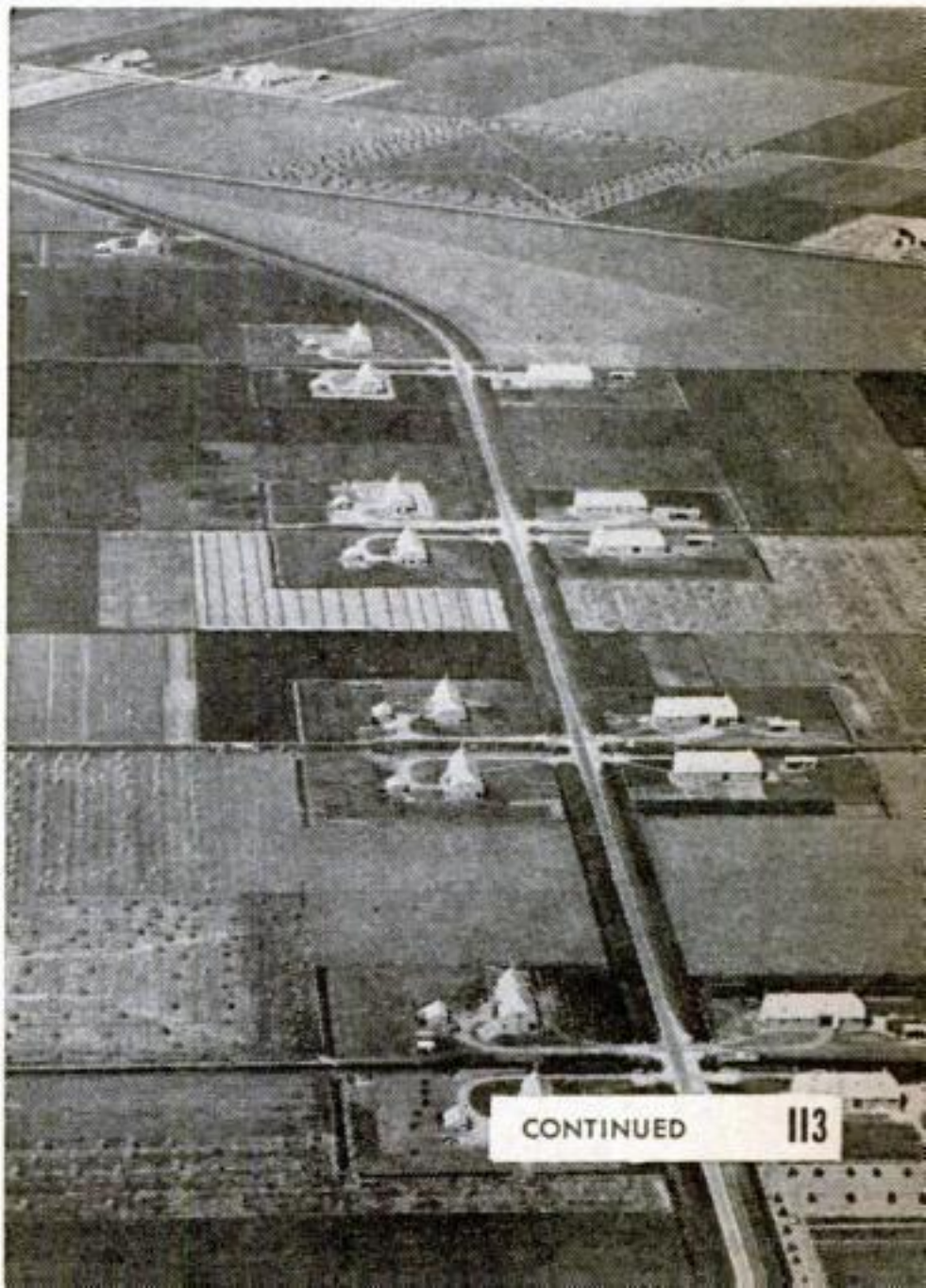


photo), and fields in foreground are being prepared for cultivation. Rotary trencher on extra-wide treads (third photo) digs a drainage ditch, hurling earth high and wide. Prefabricated barn going up (fourth photo) is one of 1,400 to be built for coming colonists.





HUGE 18½-MILE DAM, with highway atop it, bars North Sea and makes land-reclaiming project possible. It rises 24 feet above mean sea level, and spans 290 feet at waterline.

have just seen at first hand how the Dutch are working their miracle.

Gateway to Eastern Flevoland is Harderwijk, a town 30 miles east of Amsterdam. Leaving its "old" land, I drove across a drawbridge and onto a cobbled road extending to the horizon. I was atop the 56-mile dike that encircles the island polder.

On the left was the calm 10-foot-deep fresh water of Lake Yssel, which has replaced the Zuider Zee. At the right was land—oddly, a couple of yards lower than the water. Vividly I was reminded that it used to be the sea bed.

A few miles beyond, I stopped the car

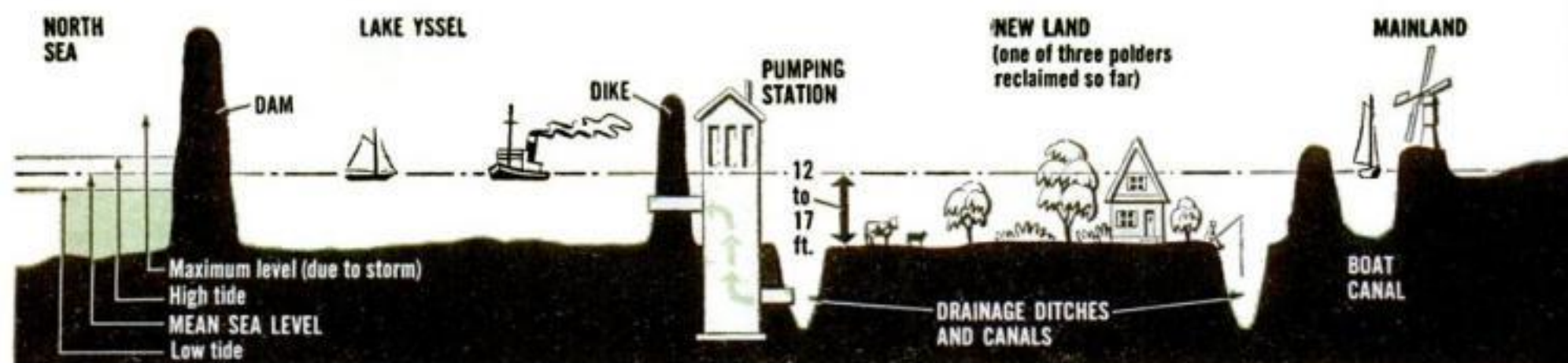
for a leisurely look. The wind rustled gently through tall brown reeds on the landward side of the dike. Water lapped at its opposite side. A brood of ducklings paddled past. A fly buzzed. Not a single soul was in sight, and 10 minutes passed before another car broke the quiet. Here was the peacefulness that comes in time to a former battlefield.

For men had battled the elements to build the grassy ridge beneath my feet—a dike some 160 feet wide at water level, 10 feet below the top of its widely sloping banks. The mammoth construction job began in 1950; the last gap was ceremonially closed, to the joyous tooting of ships' whistles, in September, 1956.

During those years of toil, dredges dug a 25-foot-deep gully in the lake bottom's soft mud, along the entire route of the dike. Barges dumped sand into it, for a firm base. Floating grab-cranes built up the dike's twin embankments of clay, past the water level. Huge brushwood mattresses were floated into place, anchored to stakes, loaded with rocks, and sunk to protect the seaward wall. Stones temporarily faced the other.

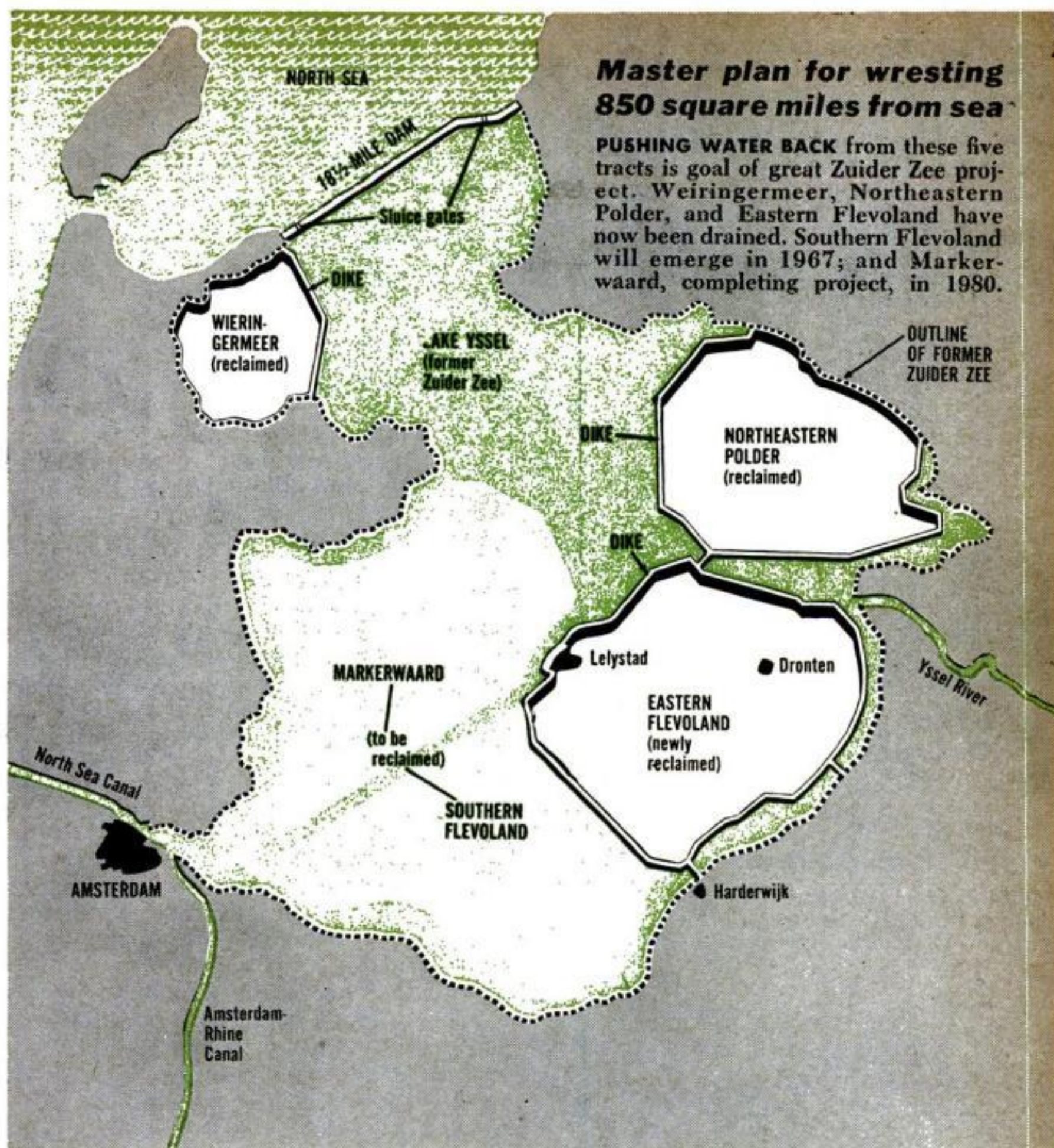
Between the parallel embankments, sand fill was pumped in hydraulically—and the body of the dike rose above water. Next came a layer of clay, and one of soil, later sown with grass, and an above-water facing of stones for the seaward side. Finishing touch for the dike was the cobbled road. It will be permanently surfaced after the ground has settled—under future traffic, soon to end the present tranquil interlude.

Besides building the dike, construction crews dredged lake-bed furrows that would become drainage canals when dry land emerged. They excavated pits for



HOW DIKES AND PUMPS gain new land for Dutch is shown in cross section (with vertical scale greatly exaggerated). Dam, keeping out North Sea, has turned Zuider Zee into a fresh-

water lake. Dike rings off a tract or "polder" of 50,000 to 150,000 acres. Pumping stations free it of water—and then, through network of drainage canals and ditches, keep it dry.



Master plan for wresting 850 square miles from sea

PUSHING WATER BACK from these five tracts is goal of great Zuider Zee project. Weiringermeer, Northeastern Polder, and Eastern Flevoland have now been drained. Southern Flevoland will emerge in 1967; and Markerwaard, completing project, in 1980.

pumping stations. At one point they broadened the dike to a plateau, with millions of tons of sand and clay, for the future town and port of Lelystad.

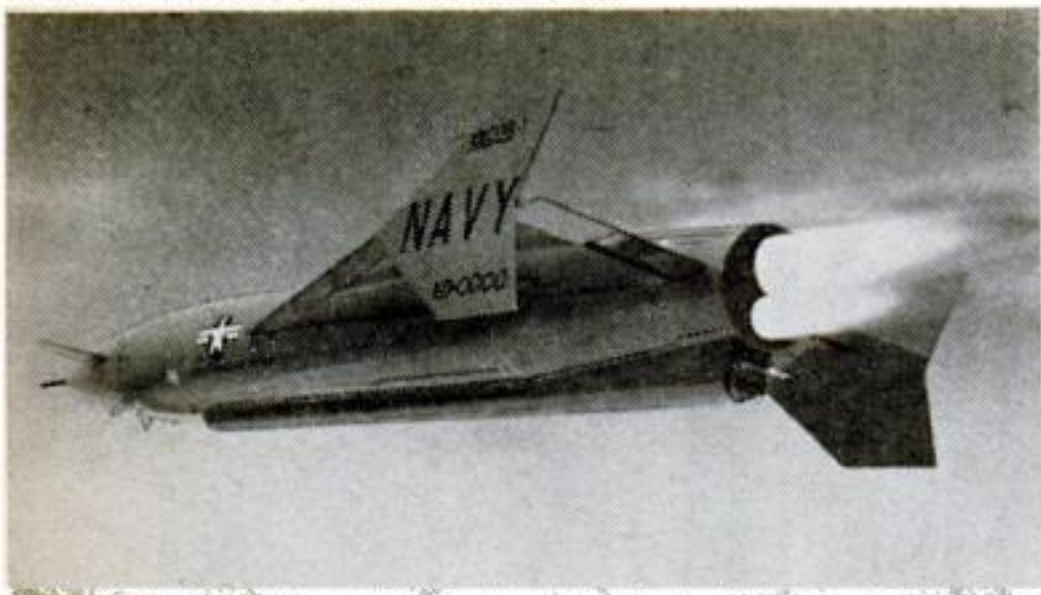
Fifteen dike-top miles flanked by blue water and brown reeds took me to Lelystad—a frontier town today, where 250 scientists, engineers, and technicians live and work in a waterfront string of wooden buildings. They are preparing the Lelystad of tomorrow, when it will have 30,000 inhabitants and will become the capital of a new four-polder province. Its name ("Lely City") honors Dr. C. Lely, Dutch Minister of Waterways who planned the Zuider Zee project 70 years ago and lived to see it begun in 1925.

Just beyond the town is one of the three pumping stations whose throbbing heartbeats have brought Eastern Flevoland to life. Its three 1,000-hp. diesel engines drive centrifugal pumps, each of which can lift 110,000 gallons of water a minute from a drainage canal to the lake's 20-foot-higher level.

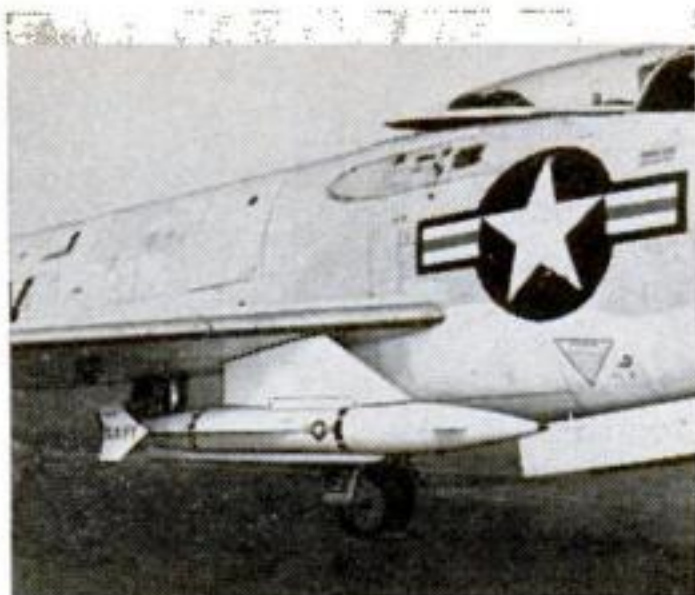
Land ho! Started when the dike was closed, the three pumping stations ran at full blast for nine months. The water, augmented by rain and snow, dropped a languid inch a day. Finally came the exciting moment when the land appeared.

Since then the predredged canals have been deepened. Next has come the for-

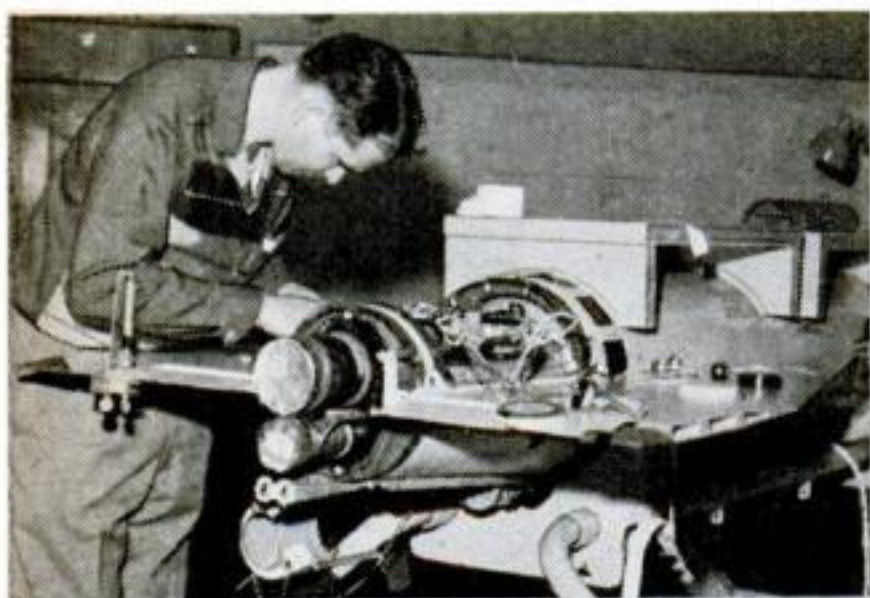
[Continued on page 213]



TARGET DRONE attains a speed of Mach 2 at an altitude of 70,000 feet. Besides speed and altitude, it simulates radar appearance of high-performance aircraft.



CARRIED UNDER WING of F3H-2, drone is released in air as target for missiles fired from ships and planes.

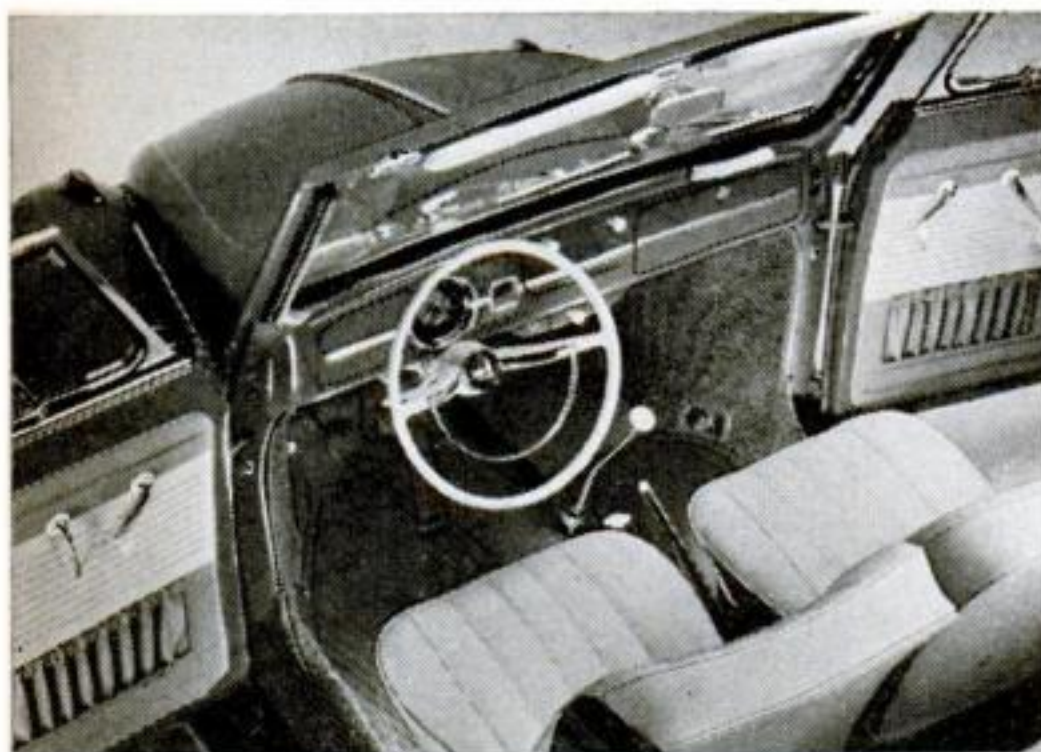


LIQUID-PROPELLANT ENGINE develops thrust of 600 pounds. It's a compact 20 inches long, 5 inches wide, 9 inches high, weighs 17 pounds.

Mach 2 target for missiles

A rocket-powered drone that flies at twice the speed of sound has been developed by the Air Force and Navy as a target for air-to-air and surface-to-air missiles. The expendable XKD2B is launched from the air with a self-contained guidance system set for an altitude of 5,000 to 70,000 feet. Though tiny, its configuration on a radar screen looks like the real thing.

The drone is powered by a 20-inch-long liquid-propellant engine with a thrust of 600 pounds. Beech Aircraft is producing the target, Rocketdyne the engine.



Gas gauge for new Volkswagen

A gas gauge will be standard equipment for the first time on the 1962 Volkswagen. It will be on the dash just to the right of the speedometer.

Heater and ventilator outlets near the floor are regulated by sliding covers. They control the direction and amount of warm air ducted in from a blower in the engine compartment or the circulation of cool air admitted from the outside.

Private catwalk

To a cat's eye, the cleated ramp below may look like a stairway to the skies, but it leads to a second-story window of a house in Brighton, Md.

J. Albert Willson installed it for his cats, Tippy and Malt. They sleep at the foot of his bed, come and go as they please. That's Malt on the ramp.



EXTRA PAGES

BIG

**Mechanics
and Handicraft
SECTION**

Winter Workshop Section

10 SPECIAL ARTICLES:

The Ancient Art of Ring Turning

Try your hand at this modern version of an old, old way of turning out duplicate wooden items in the numbers you need

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How to Avoid Common Woodworking Troubles

A collection of tips from a man who has spent his lifetime solving such problems

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Shop Equipment You Can Make

Plans for a quick-acting vise, contour sander, rolling shop light, cleanup dustpan

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Make Wooden Gears? Why Not? Here's How

A challenging project right out of the inside of a tall grandfather's clock

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3 Quickly Made Sawhorses

Who ever has enough of them? Here's how to add more to your own shop collection

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Getting Full Value from a Radial Arm

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How I Rebuilt a Cider Press

This man found the working parts of an old hand press, replaced the wooden parts, and now has a fine machine. You can, too

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Home-Shop News Report

A roundup of recent happenings of interest to men who buy and use tools at home

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Miracle Hi-Fi Speaker? Well, Maybe

A special report from England on a home-made speaker that many rave about. You can get plans to make your own—and try it

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ALSO: 14 Pages of Special Projects

More than enough ideas and working drawings to keep you busy all winter. Beginning on

PAGE 173

Half a Dozen Pages of Home Shop Tips

Every one has been shop tested by other readers of POPULAR SCIENCE

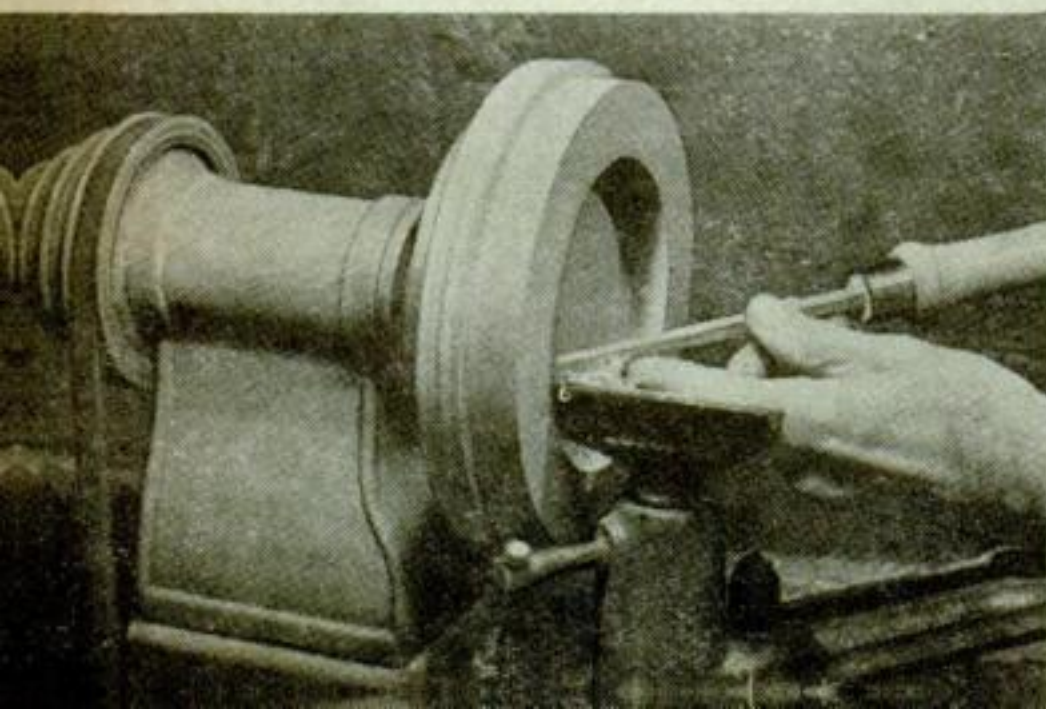
A PS Winter Workshop SPECIAL

Imagine the most intricate object you can. Chances are that it can be mass-produced with this modern version of—

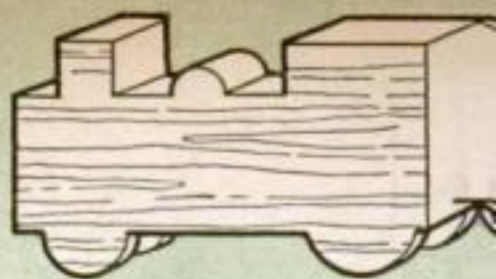
The Ancient Art of Ring Turning

By Walter E. Burton

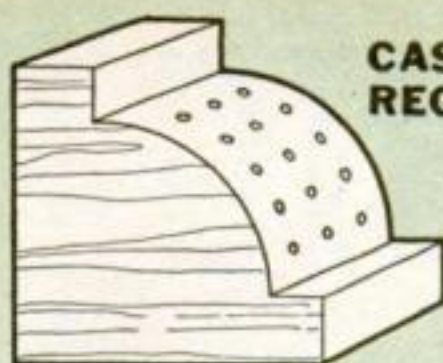
LONG before modern, quick-molded plastic toys, early European craftsmen used a fascinating method of mass-producing wooden soldiers, animals, ship models, and other objects. They shaped a wood ring on a lathe so its



TOY TRAIN



CASH REGISTER



BADGE

cross section represented, say, a ship hull. Then they sliced the ring like an angel cake, coming out with a whole fleet of identical little ship hulls.

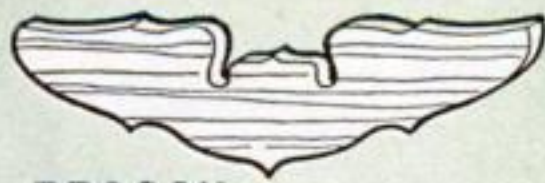
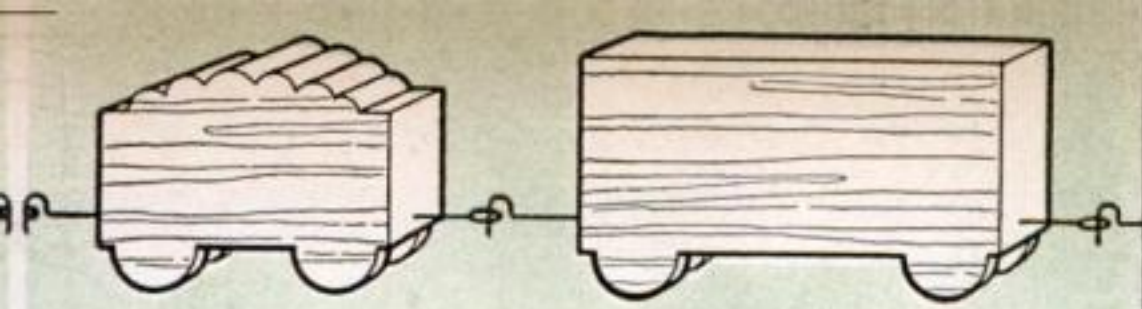
This remarkable method, recreated here, is an ideal way of combining the fun of lathework with the practical job of turning out duplicate shapes for toys or ornaments. The possibilities are endless: fleets of fighting ships staging famous battles, a speedway filled with colorful Indianapolis racers, sets of miniature cars and buildings for a model-train layout.

By cutting the rings into very thin slices, you can also turn out flat profiles of animal heads, hearts, shields, and other designs for novel cuff links and women's brooches. These can be mounted on standard brooch-pin and cuff-link blanks available at jewelers.

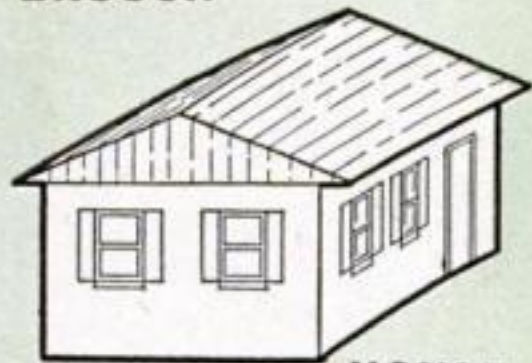
How the method works. It's the same as faceplate turning, except that you start with a wood ring instead of a solid disk. For most designs, you turn only one side of the ring, producing a profile on the face and leaving the back flat.

DESK-SET
DECORATION

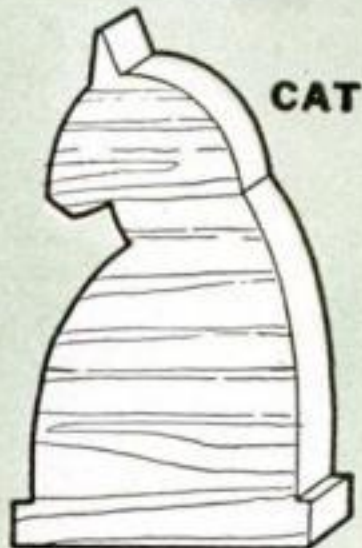




BROOCH



HOUSE



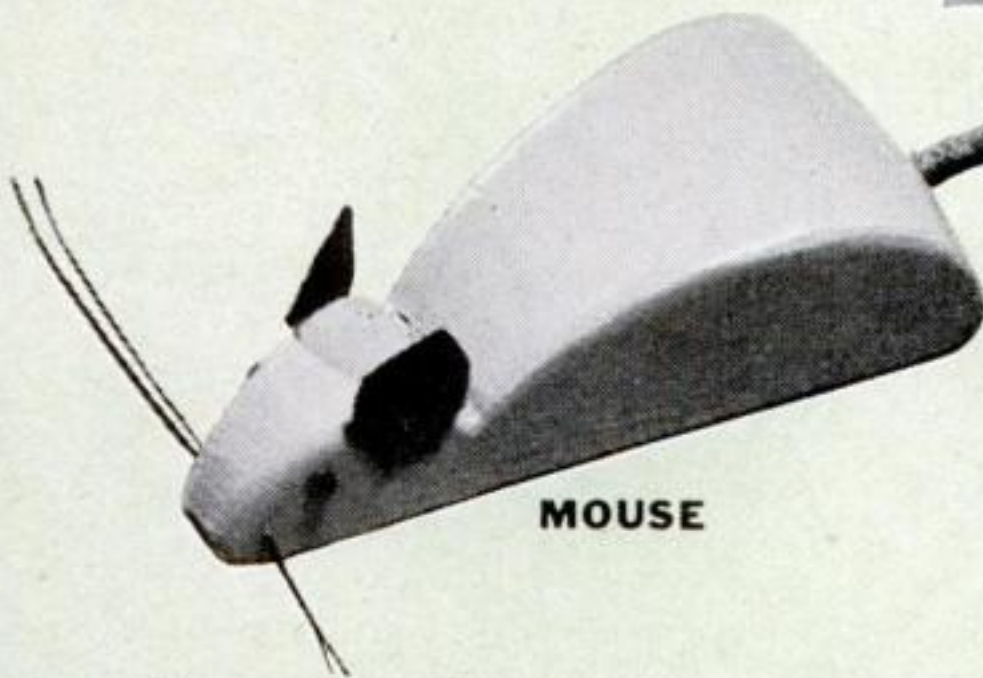
CAT



TANK



GALLEON

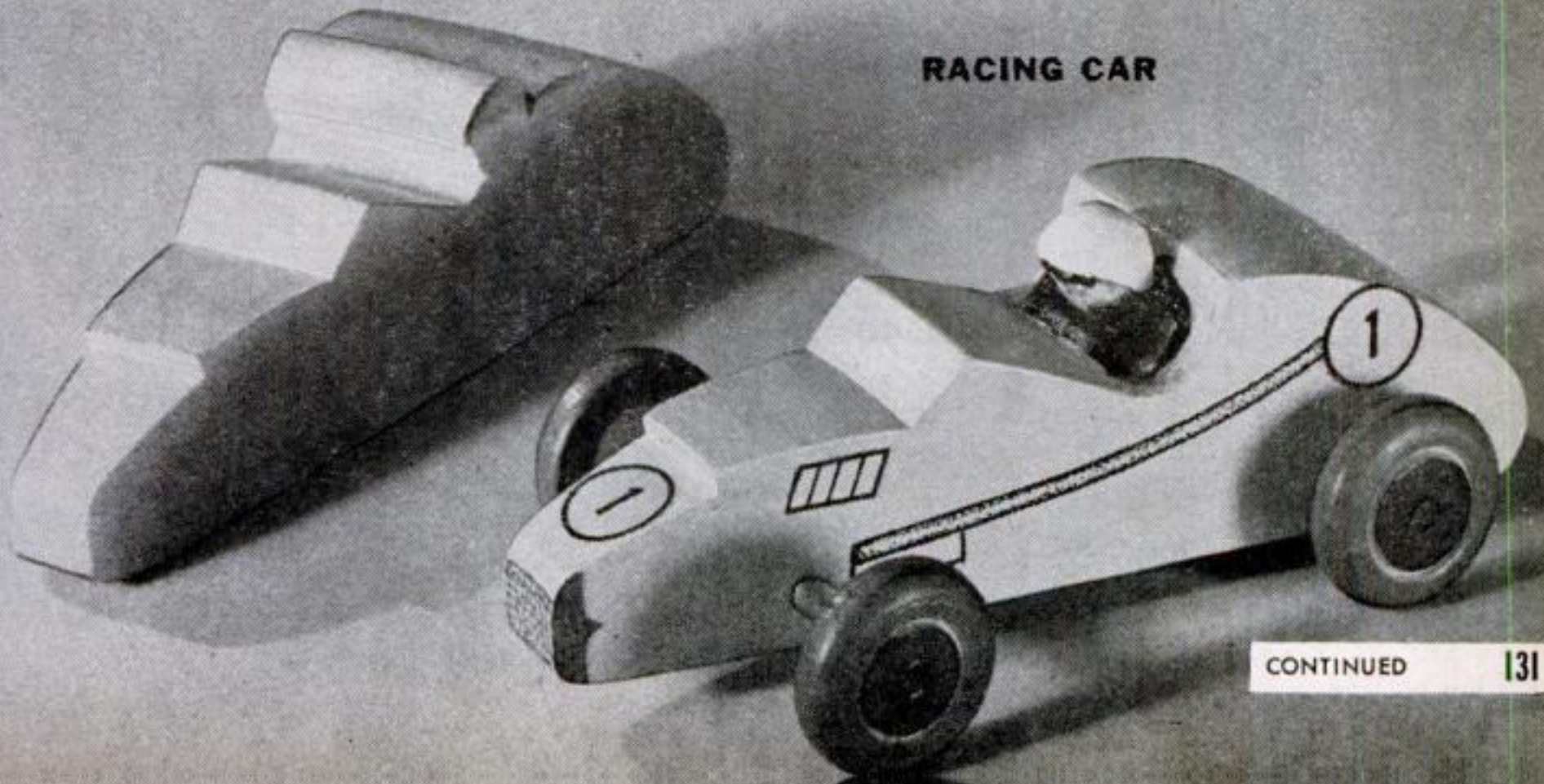


MOUSE



TURTLE

RACING CAR



More intricate shapes can be made by reversing the ring and turning the back side as well or by mounting it between lathe centers so both sides can be worked at the same time.

The slices cut from the ring naturally have slanted sides—the smaller the ring, the sharper the slant. Often these wedges help in shaping a design, such as in the broad-backed racers shown here. For straighter sides, increase the diameter of the ring or cut parallel-sided segments out of it.

As in any lathe turning, a good hardwood like maple is better than softwood for precise detail. Where you need a thicker ring than stock lumber allows, build one up by gluing layers together. Always make the ring slightly oversize so truing cuts can be taken first.

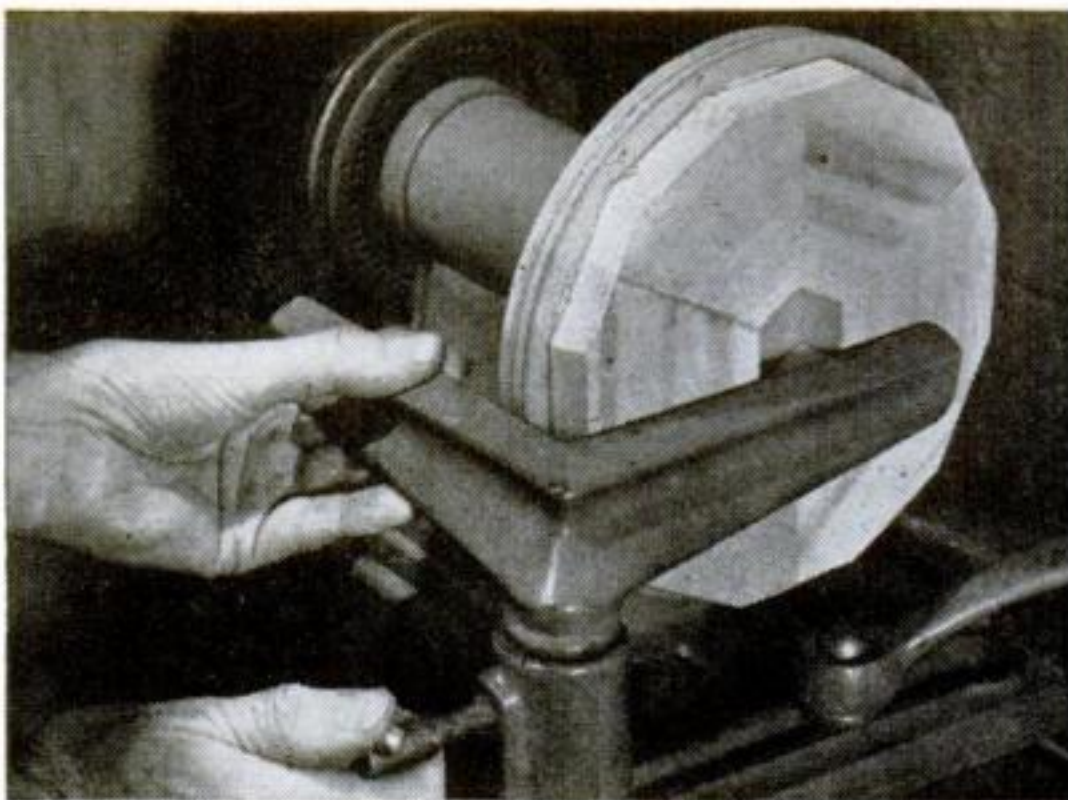
The direction of grain in the ring slices will vary according to which part of the ring is cut. In some cases, for strength or appearance, you may want the grain to run the same way in all pieces. This can be done by gluing up a ring from mitered sections instead of using a solid piece.

Mounting the rings. Neatest trick is to glue the ring to a cardboard disk first. This is then fastened to a $\frac{3}{8}$ " or $\frac{1}{2}$ " plywood backing disk by running screws from behind into the back of the ring. Make sure the screws don't protrude into any area where wood will be removed. The backing disk is then screwed to the faceplate through the conventional slots. When the finished ring is removed, the cardboard disk comes with it. A pivot nail through the cardboard then gives you a handy way of keeping the ring securely centered when you saw it into slices.

Where screws can't be run into the ring, it can be glued to the backing disk. A sheet of paper inserted between the two will allow the ring to be pried off easily later. Where a ring is to be turned on both sides, mount it on a hub (see photo). The hub keeps the ring centered when you reverse it. You can use a similar hub to center the ring as you slice it when the cardboard disk can't be used.

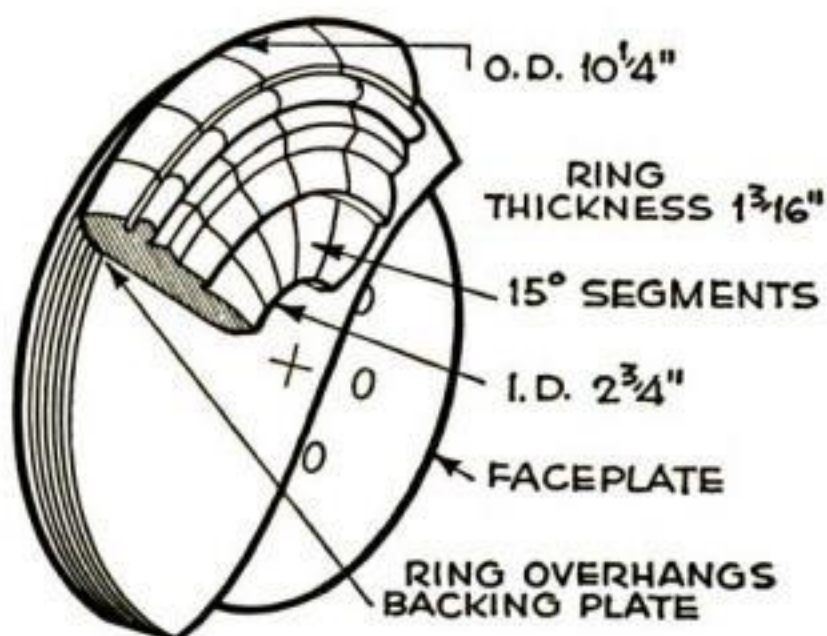
Turning cylinders. Some designs are more easily formed from a cylindrical blank rather than a flat ring. In this case, you build up a cylinder and mount

How the turn-and-slice method



A BUILT-UP RING is used here to keep grain direction the same in all slices. Six wedge-shaped sections are edge-glued, then trimmed off at the points to a roughly round shape.

For a fleet of Indianapolis

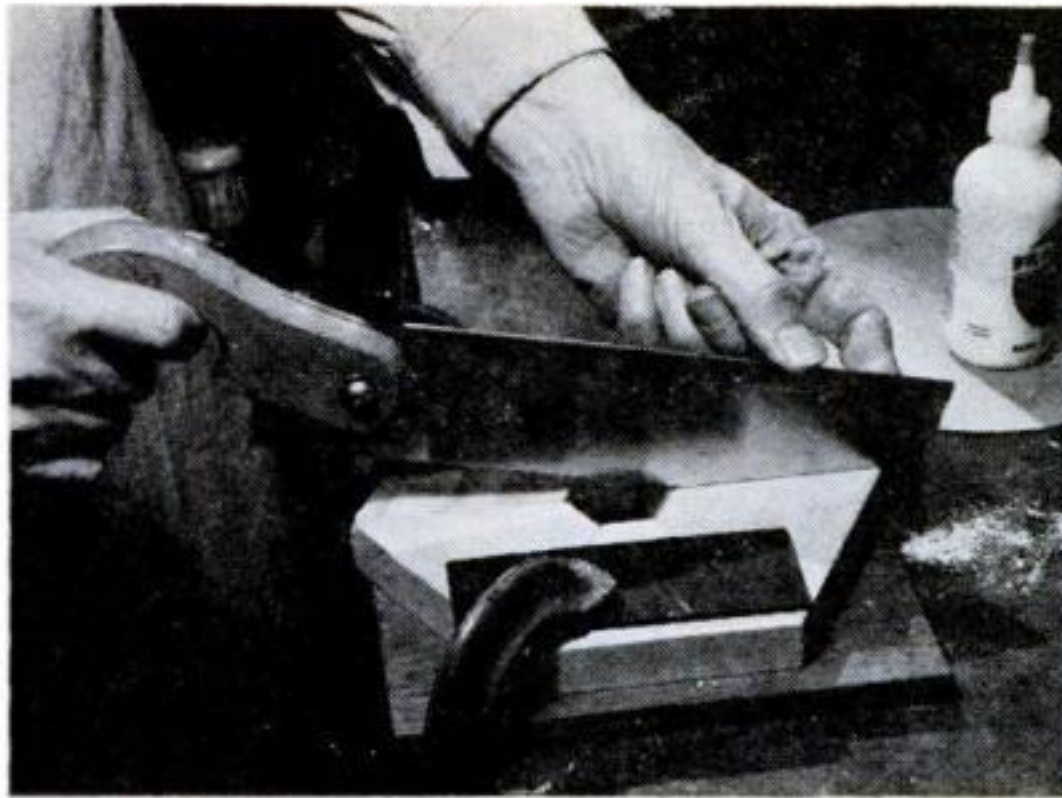


it between the lathe centers instead of on the faceplate. Turning is then done along the *edge* of the work rather than the face.

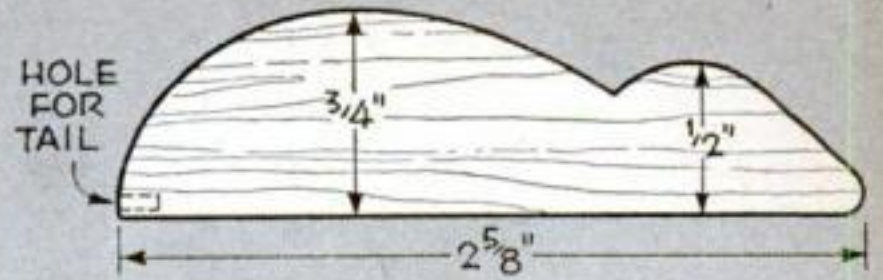
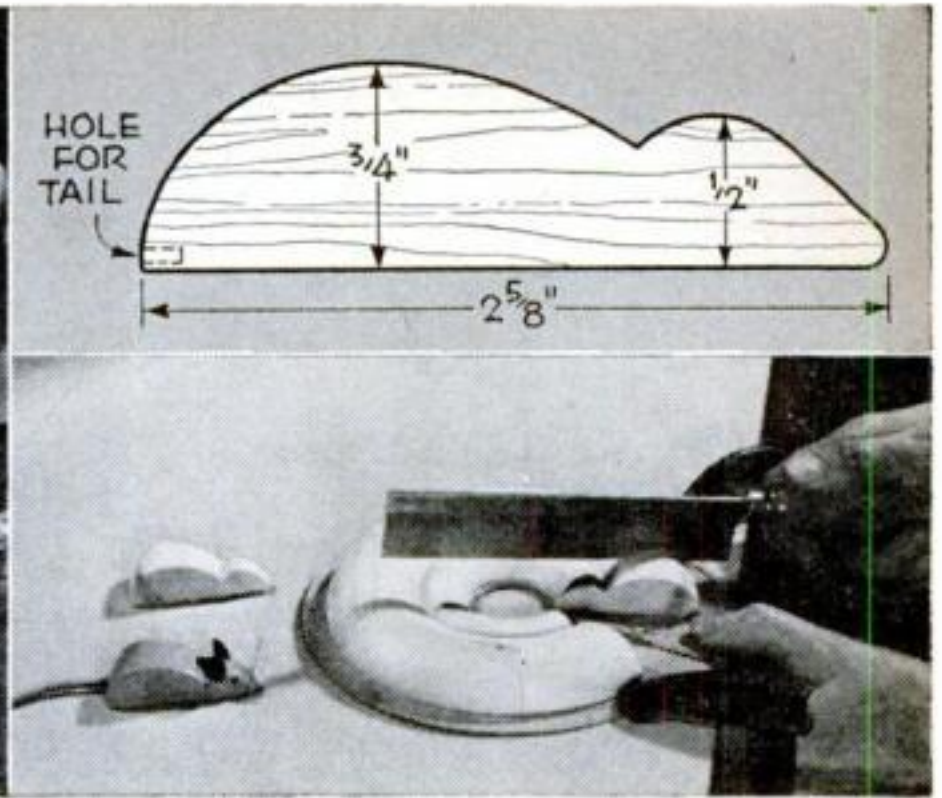
The rakish Spanish galleons shown are a good example of cylindrical turning. Note that the hulls *could* have been shaped from a flat ring, but that the decks and cabin roofs would have been unpleasantly flattened. By turning the hulls along the edge of the cylinder, the decks and cabins automatically come out neatly rounded.

Because a cylinder is not as easy to slice apart as a ring, you use a special trick. You form the cylinder around a mandrel by edge-gluing wedge-shaped sections that are exactly as wide as the finished sections you want. After the

works: A single ring produces a whole family of comical mice

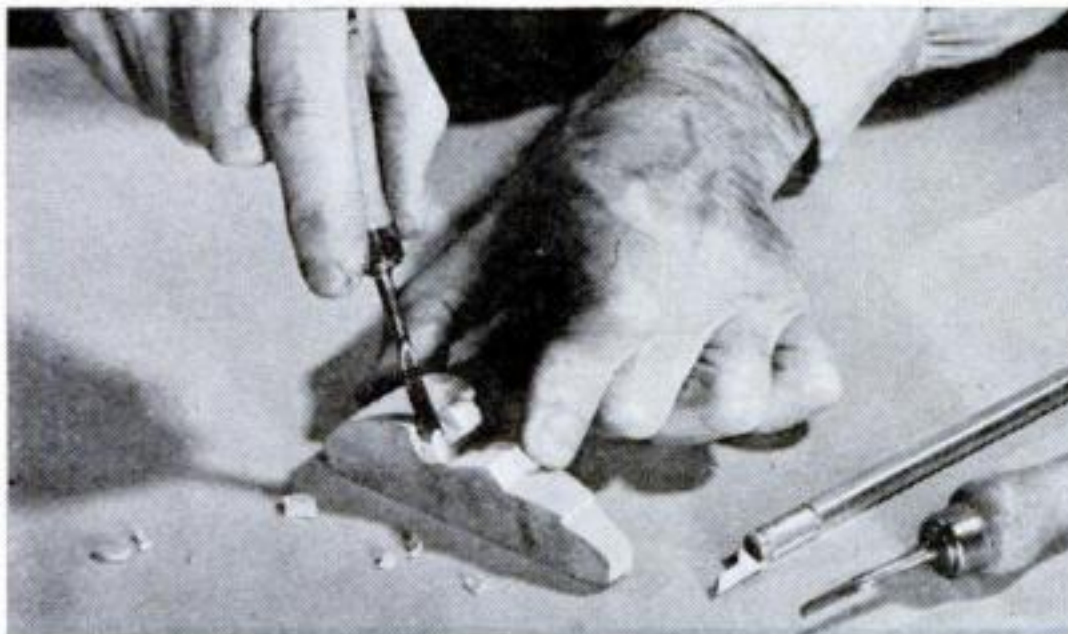


FOR A PRECISE FIT of the ring's parts, first glue them into two half-rings and clamp the halves together. Sawing through the touching edges provides perfectly mating joints.

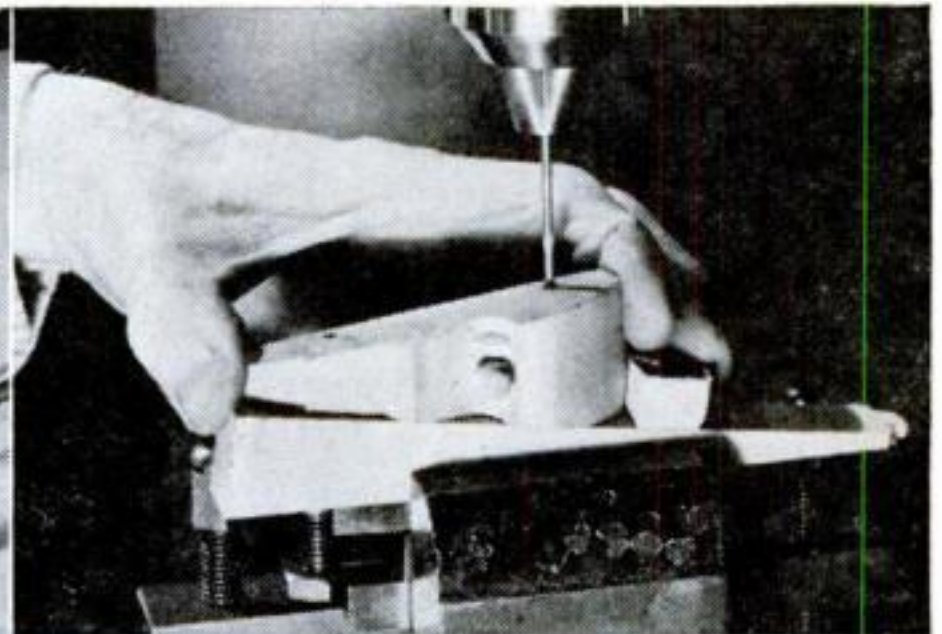


SLICED LIKE A PIE, finished ring yields tiny "mouse" profiles. These are sanded, lacquered, and trimmed with glued-on leather ears and tail, glass-bead eyes, brush-bristle whiskers.

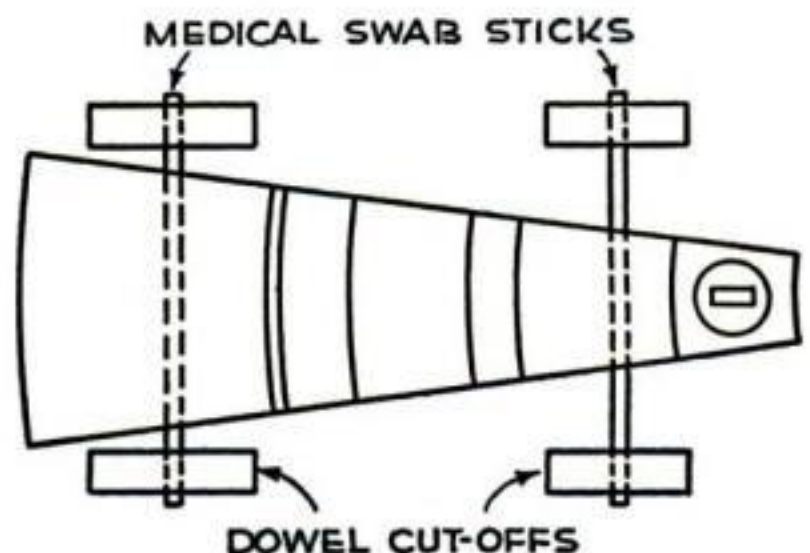
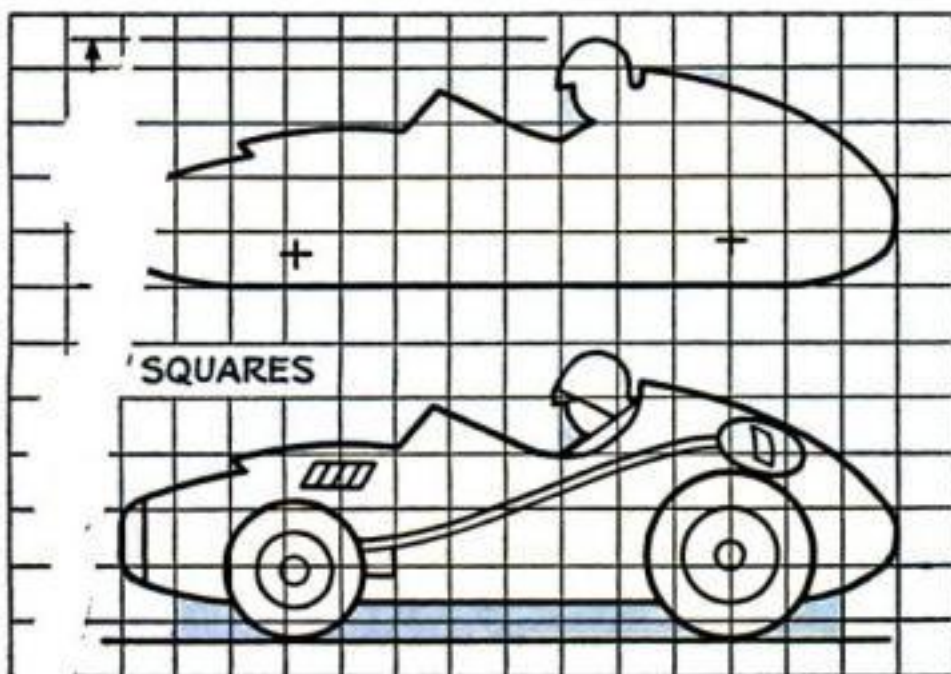
racers, you add a bit of hand carving and attach wheels



YOU GET 24 MODEL RACERS from the setup at far left. Each racer body is a 15-degree section of the ring. Note that the ring overhangs the backing plate slightly. This enables you to shape the racers' rear underbody curve without having to remove the ring and reverse it.

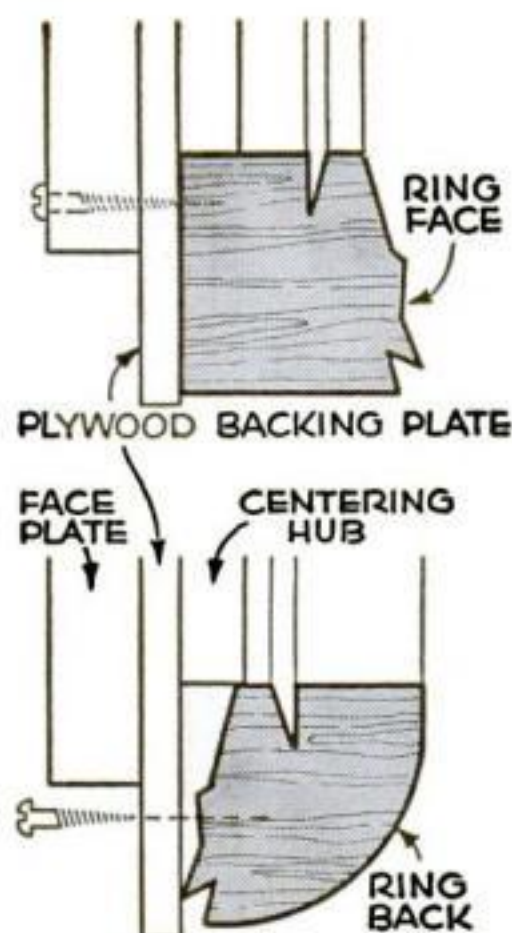
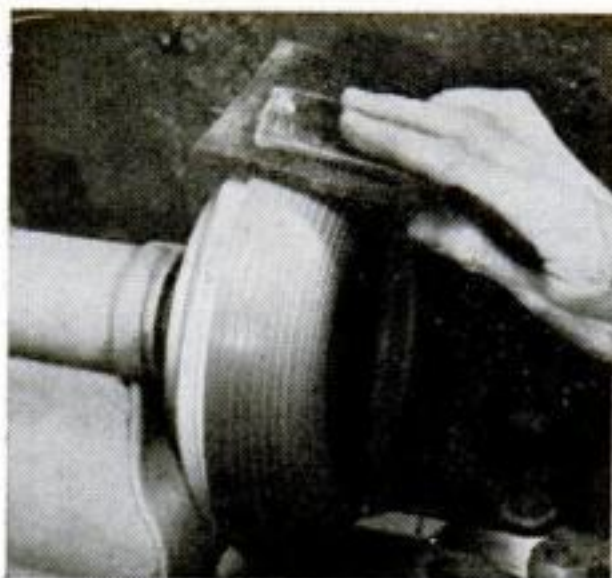
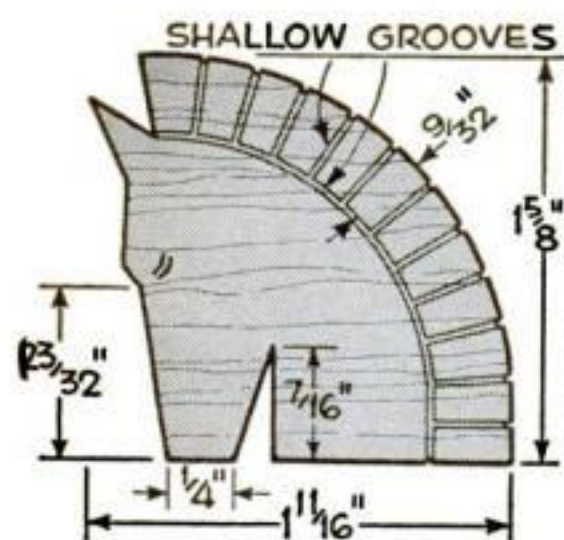


A little hand carving, as at left, turns the driver's profile into a realistic figure. At right, axle holes are drilled straight by leveling each body segment on a scrap wedge sawed at a 7 1/2-degree angle. Make holes slightly over-size so axles will turn freely.



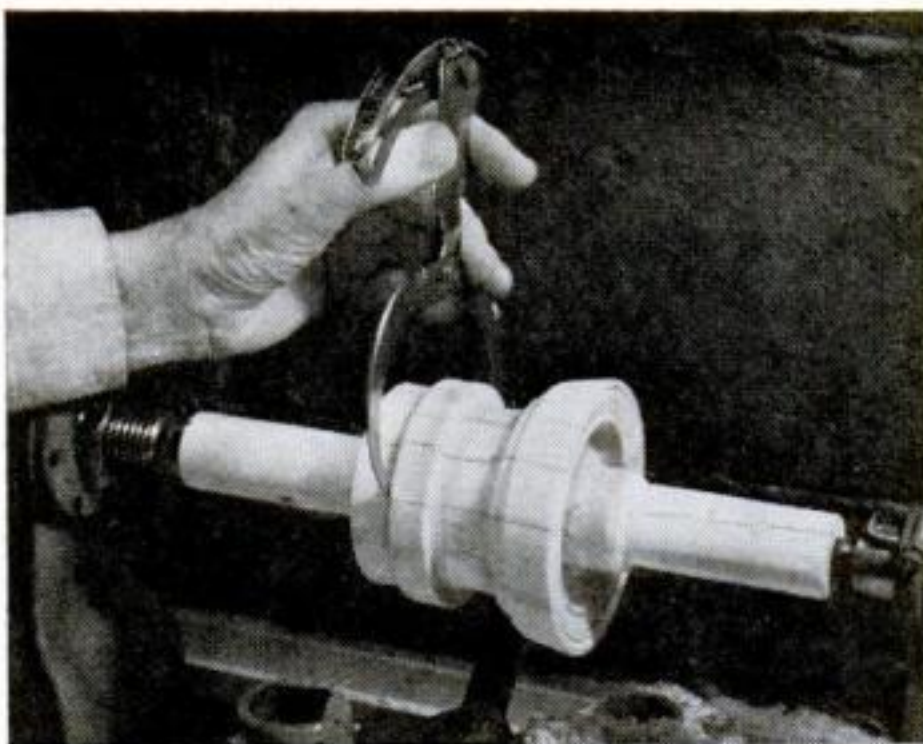
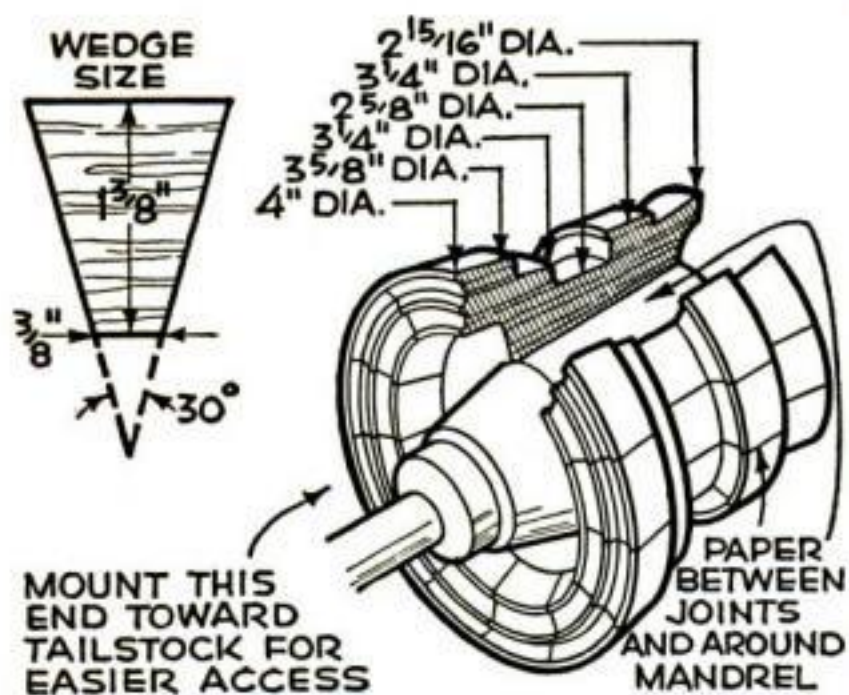
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How to mount a ring so you can shape it on both sides



DECORATIVE HORSE HEADS are made by mounting a ring over a hub so you can reverse it to shape both sides. The hub keeps the ring centered when you flop it. Three screws hold the ring to the backing plate. When the slices are cut, those containing screw holes are simply discarded. Grooves for the horses' manes are made by scoring the ring while still on the lathe and hand carving the sides of the heads to match later. Final smoothing is done here with an abrasive kitchen scouring pad held against the spinning ring with a rubber strip to back it up.

For the Spanish galleons, you glue up a cylinder like this

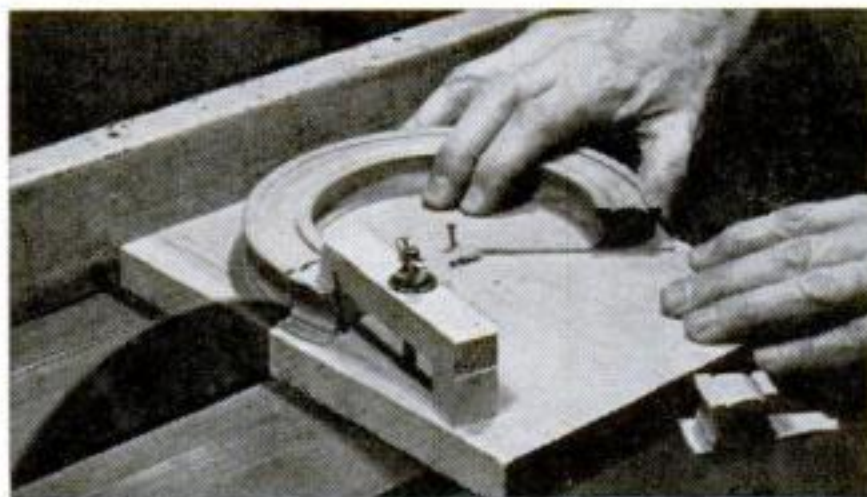


CYLINDER IS BUILT UP by edge-gluing 12 $4\frac{1}{4}$ "-long wedges around a mandrel, as above. Paper spacers glued between the wedges and around the mandrel permit the cylinder to be broken apart easily after turning. Rough-shape

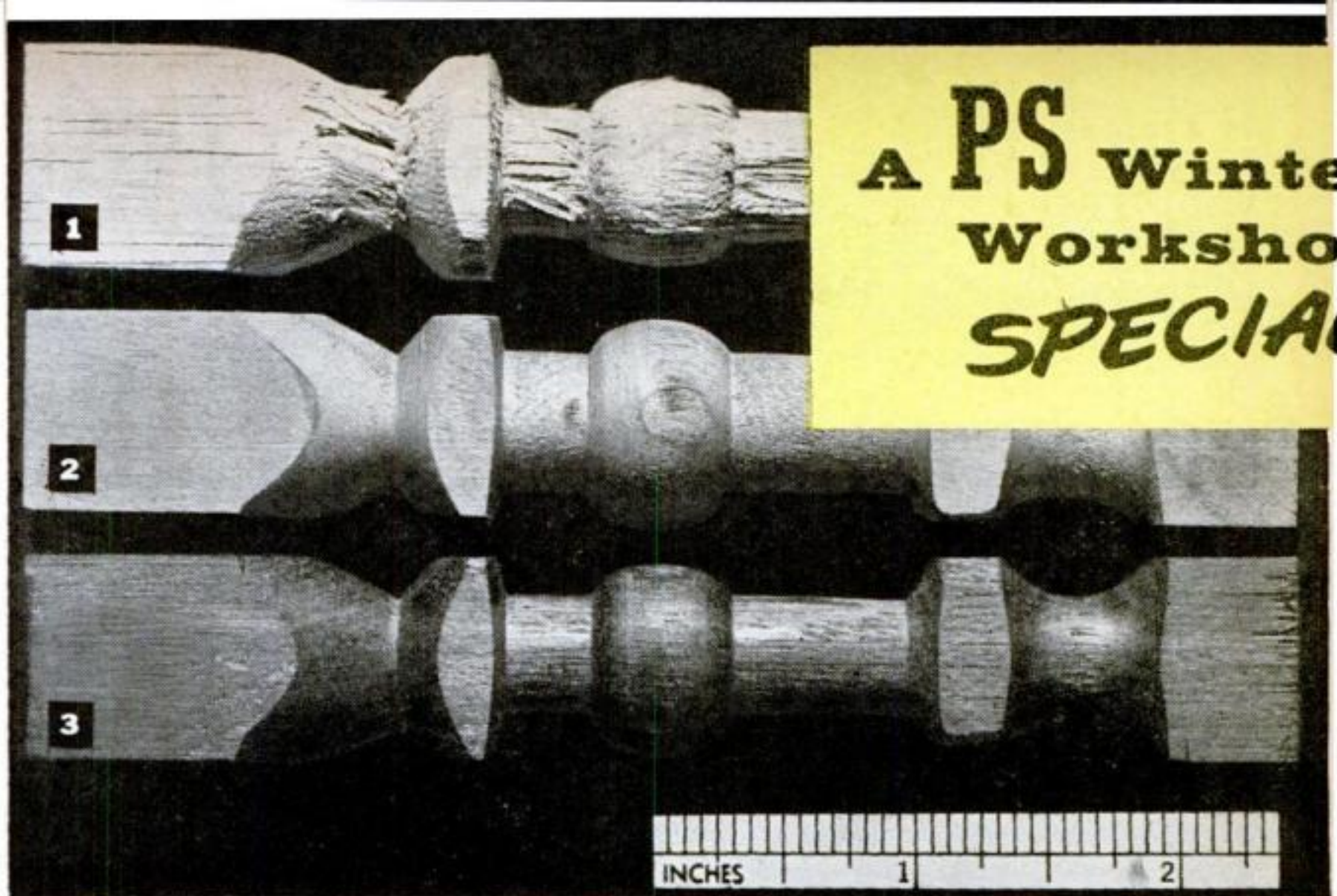
the cylinder to the diameters shown, then check final contours with a template. Sails, shown on a preceding page, are paper glued to wire masts. Hulls can be mounted on pedestals or weighted with lead to stand by themselves.

cylinder is turned, you simply break it apart along the glued joints, coming out with perfect slices with no sawing. Paper spacers inserted in the joints will permit the sections to be pulled apart easily.

Whatever the mounting method, keep lathe speed moderate. Use templates to check the shape as you go. Before removing the turning, smooth it with fine sandpaper. A final treatment with a handful of lathe chips held against the spinning ring produces a high polish on hardwoods. ■ ■



A RING-SLICING JIG can be made like this. Tack the ring to a block at the center of its cardboard backing disk and rotate it for each cut. A nail acts as a stop, making all slices equal. A wingnut clamp holds the ring firmly.



SPLINTERED TURNINGS result from using a wood that's light and soft like balsa (1) or heavy like

this rare African haplormosia (3). Clean turning (2) is cherry, a wood of medium weight.

How to Avoid Common Woodworking Troubles

By E. M. Davis as told to F. A. Streng

YOU buy good lumber, plan a project carefully, lavish your time and skill on it, and still something goes wrong.

When this happens, you have lots of company, including some of the experts. There's plenty of evidence of this in the mail I get at the U. S. Forest Products Laboratory. Over the years many a puzzled boss of a woodworking plant has asked "how come?" about things like fuzzing, chipping, gouging, grain raising, and splitting.

The difficulties very likely spring from three causes:

- Shortcomings in the wood.
- Faulty seasoning.
- Faulty machining.

Shortcomings in the wood develop in the forest trees. They grow fast or slow, straight or crooked, lean or fat. The results show up in such things as density (weight per cubic foot), rate of growth in

trunk diameter, wild grain, tension wood, and mineral streaks.

Density depends mainly on species. Willow and cottonwood are so light in



E. M. DAVIS, who wrote this article with F. A. Streng, has spent 30 years researching wood-machining problems at the U. S. Forest Products Laboratory, Madison, Wis. In the photo above he is seen at work on a shaping test.

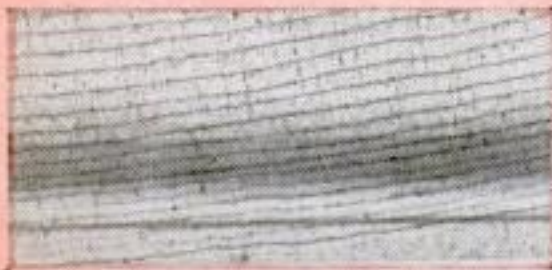
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Six factors that affect the machining of wood

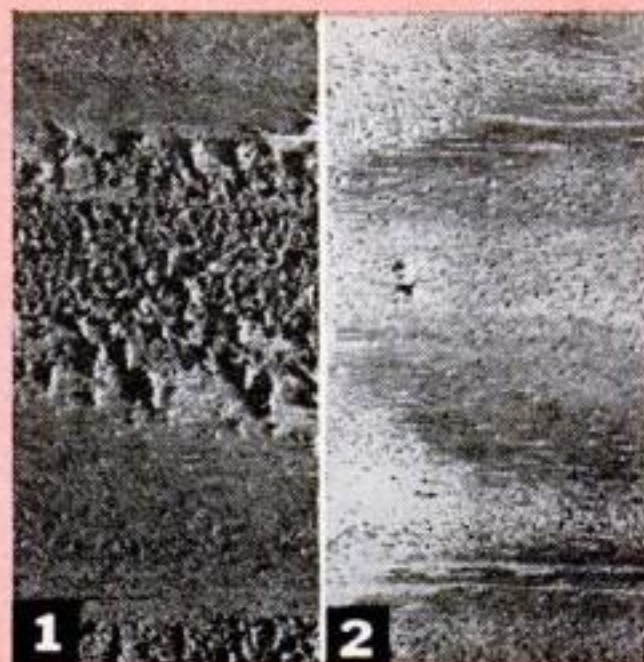


RATE OF GROWTH affects a wood's machining properties. Fast-grown ponderosa pine (top left) chipped badly on end grain. Slow-growth wood in lower left photo cut smoothly.

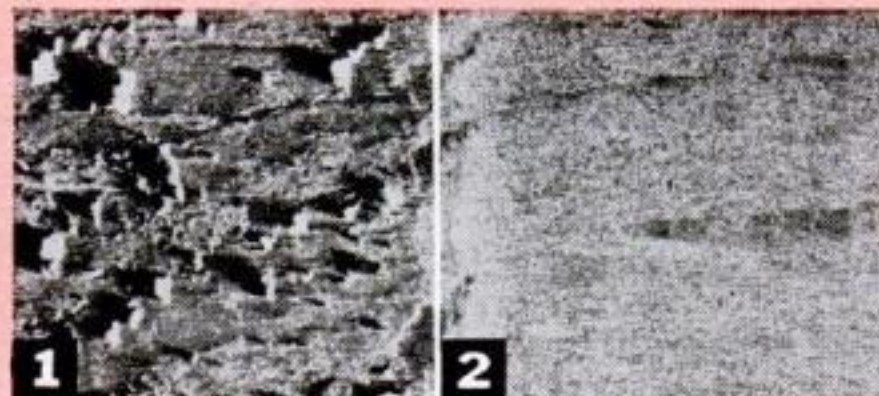


TENSION WOOD, a mysterious growth abnormality common in leaning trees, caused this mahogany to fuzz badly (1). Fuzz can be stiffened with shellac and sanded when dry (2).

(All samples are actual size.)



DIAGONAL GRAIN chipped out of maple sample (1) when ends of grain were fed into jointer. Lower sample (2) cut smoothly when run through with the diagonal grain trailing.



EXCESS MOISTURE in this wood caused it to fuzz badly (1) when planed. Same piece was later planed smooth (2) after being dried to about eight-percent moisture content.



weight that they tend to crush, tear, or fuzz when cut under conditions ideal for a heavier wood. Hickory and lignum vitae, on the other hand, are so heavy they have to be machined very slowly. Even then, they dull tools fast.

For best results, select species from among the great middle-weight woods—hardwoods like maple, birch, sweet gum, oak, walnut, cherry; and softwoods like pine, fir and spruce. There'll be some variation in weight even among trees of a species but it usually isn't important.

Growth rate among trees of a single species is more serious. The growth rings on the end of a piece tell you how fast the tree trunk grew. Wide rings, two or three to the inch of radius, mean excessively fast growth. Within limits, the slower the tree grew—the more rings per inch—the better for machining purposes.

Diagonal, or wild, grain is a main cause of surface chipping on wood put

through the planer or jointer. It can happen as the tree grows, if the fibers of the wood grow at an angle other than straight up and down in each annual ring—that is, tend to spiral around the trunk. Or it can happen during sawing if the sawyer doesn't compensate for log taper.

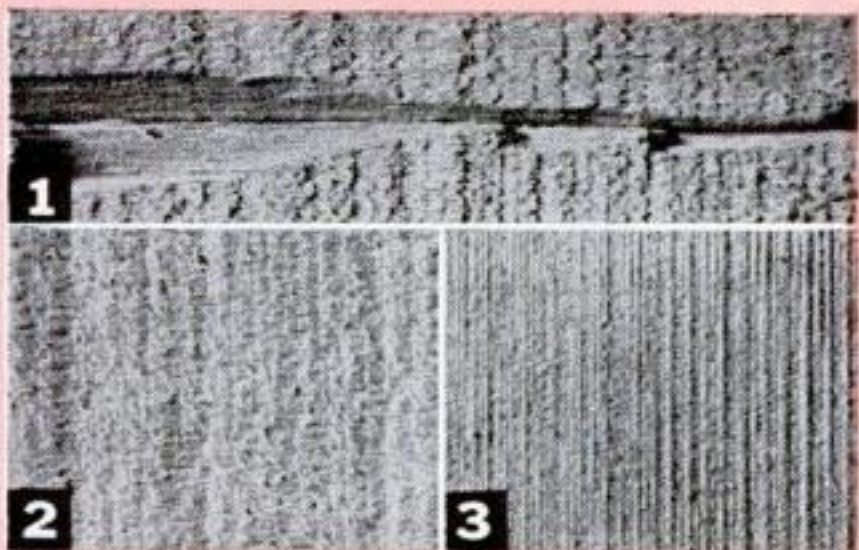
In either case, the fibers don't lie flat with the surfaces of the sawed board. Instead, these hollow cells—about 1/25" long in hardwoods and up to 1/8" in softwoods—tend to angle into the board.

Telltale signs. You can often spot diagonal grain by fine cracks or checks on the edges of a dry piece if they aren't parallel to the corners. Be sure to put such pieces through a planer or over a jointer in the direction in which the fibers slant into the wood, so the knives can't break chips loose.

Fancy-grained woods are especially likely to be wild-grained. In curly maple, grain slopes in both directions. For such



EMBEDDED MINERALS show up in wood as dark streaks. In this sample, a mineral nicked the jointer knives enough to leave the trailing ridge which you see at right of the streak.



DULL TOOLS are sometimes the trouble. Dull bandsaw caused tears and roughness in examples (1) and (2) above. In contrast is smooth cut (3) made with a sharp blade in bandsaw.



woods, make only very light planing cuts, and pass the wood slowly over the jointer. If you can control the feed roll on your planer, slow it down.

Tension wood is a mysterious abnormality in hardwoods. It tends to be most common in leaning trees. It causes serious fuzzing during planing and sanding, mainly in lightweight woods such as willow and cottonwood, but also in mahogany. In heavier woods, it causes little trouble. Examine wood of lightweight species for fuzz when you buy it. If fuzz pops up when you work it, stiffen the fuzz with shellac and sand it off.

Be wary of dark streaks in wood. They sometimes contain minerals, usually hard calcium crystals. Even in as light a wood as balsa, a pencil-thin streak can nick cutter knives enough to leave small ridges in the wood.

Well-seasoned lumber is a must for good machining. Green wood can spoil a

perfect woodworking job—like a time bomb, long after you've finished it. It is likely to fuzz and tear while you work it—an effect most common in lightweight softwoods like spruce. Softwoods are also likely to develop raised grain if too “wet” when you machine them. In planing tests, I found that softwoods machine much better at 6-percent moisture content than at 12 or 20 percent. So buy dry wood. If, to save money, you buy green lumber and set it aside to dry, coat the ends with asphalt roofing compound to keep them from cracking open.

A warning. And always remember that, even if you succeed in machining green wood as you want it, the stuff will dry out later. That will mean shrinking—with a strong probability of checks, warp, and splits, especially in pieces nailed, glued, or otherwise held together. Fastenings only make wood struggle and twist as it shrinks.

When you're buying lumber for woodworking, avoid so called “heart-center” pieces. These contain the pith of the tree. In particular, don't use them for turning squares. They're prone to check—open small cracks—after being turned, especially if not seasoned enough.

The most carefully selected wood, well seasoned, isn't safe from faulty machining. A tool is no better than its operator. Even a handsaw with teeth perfectly set and filed can damage wood, chipping out the lower face, if you bear down too hard. And no woodworker worthy of his craft knowingly uses dull tools. From this, two simple rules are obvious.

1. Take it easy.
2. Keep cutters sharp.

Whether it's a simple hand chisel, a scraper, a turning gouge, or a power saw or planer, there's no substitute for a keen edge. Even a slightly dulled gouge is a crude, unmanageable instrument of destruction on a fine piece of wood whirling in a lathe. Dull jointer or planer knives will quickly tear and chip costly fancy-grained woods or pound and compress them, leaving a glazed surface that's likely to break out in a rash of raised grain.

Taking it easy is mainly a matter of patience, and patience is as essential to good workmanship as is skill. This is particularly true with modern power

tools, which so largely eliminate the need for manual skill that hand tools demand. You can chip the underside of a board with a power saw just as badly as with a handsaw by forcing the wood through the machine too fast.

The glue in plywood rapidly dulls tools. If you're going to cut very much of it, get carbide-tipped cutters or a plywood-cutting blade.

Your home-workshop machines probably operate at a set rim speed. That means that your main control is the rate of feed. The slower you feed a piece, the more teeth or knives come into action in a given length of cut. That means smoother cutting, because each tooth or knife has to nip off less wood. For planing, I've found 16 to 20 knife cuts per inch of board length about right.

Take your time. The usual home-workshop planer has one speed for cutter-head and feed roll. This limits your control even more. About the only thing you can manage for yourself is the depth of cut. Go slow—use shallow cuts. To remove 1/16" of thickness, take two cuts at 1/32", even if the machine has plenty of power for a 1/16" bite.

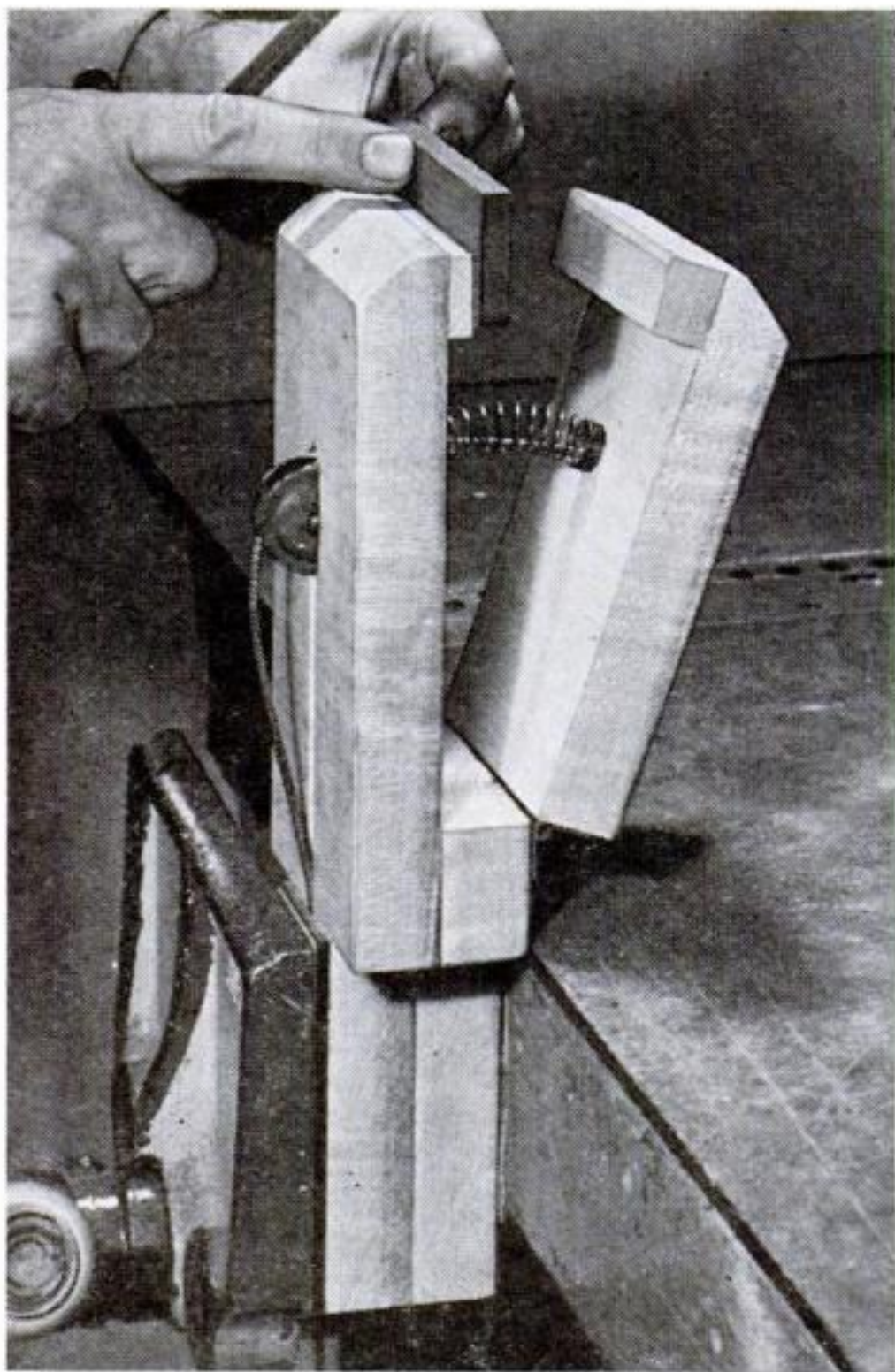
While on the subject of planing, here's a tip for smoothing planer-knife marks, especially on the denser hardwoods. A sharp hand scraper will remove chips and ripples better than sandpaper, which may also pack wood flour into cavities such as the large pores of oak.

The light, careful touch is best even for such an apparently harmless operation as sanding. For softwoods a 2/0 sandpaper is generally coarse enough; coarser papers may tend to hollow out the light-colored springwood of each annual ring, which is softer than the darker summerwood.

For the coarse-textured woods like oak, a coarser grade is more suitable than on fine-textured woods like maple or birch. The relatively large pores and other character marks in oak conceal sander scratches that would show up, for instance, on birch. For sanding off tension-wood fuzz on lightweight woods, a 2/0 grit is good, and for resinous woods like the southern pines you'll find that an open-coat abrasive paper clogs less.

So enjoy the work—and the wood—and take your time. Remember, nature took plenty in growing the stuff. ■ ■

Four for the Shop



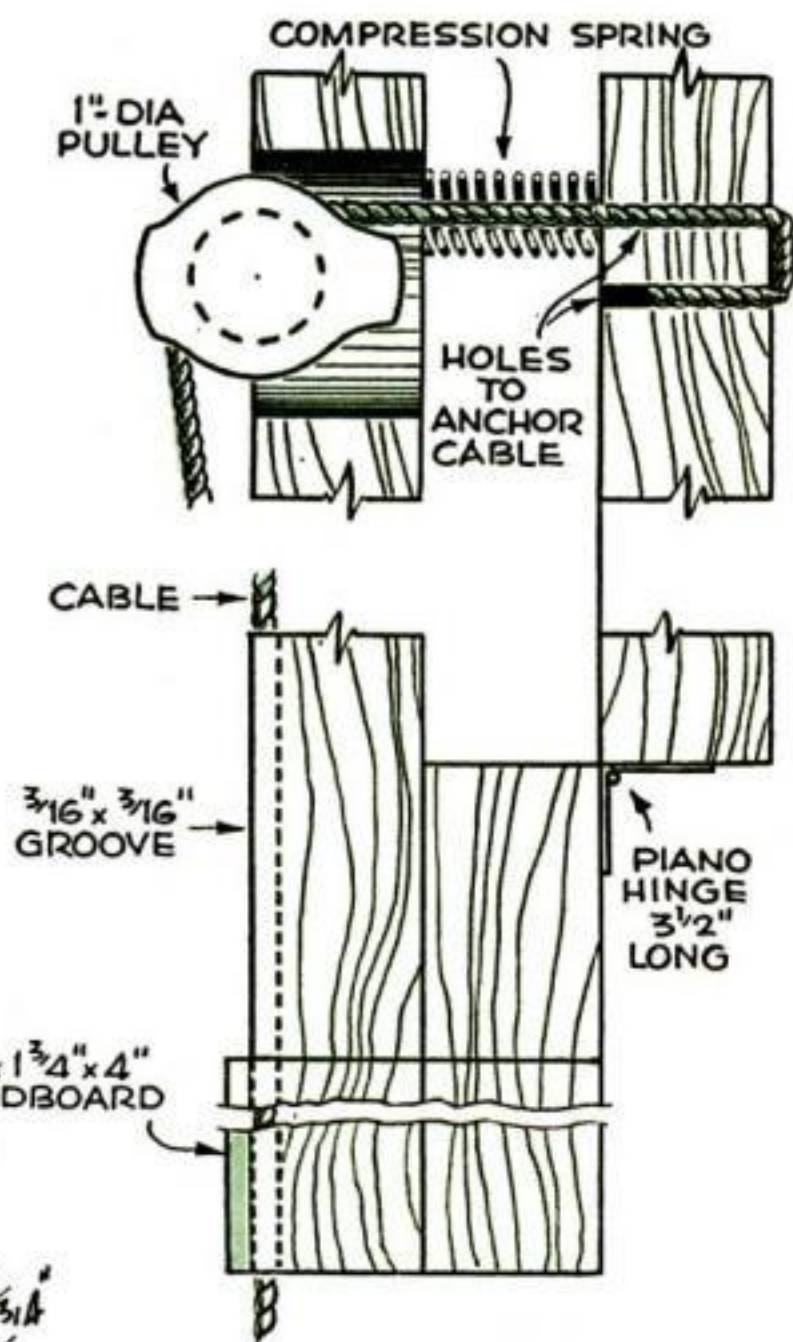
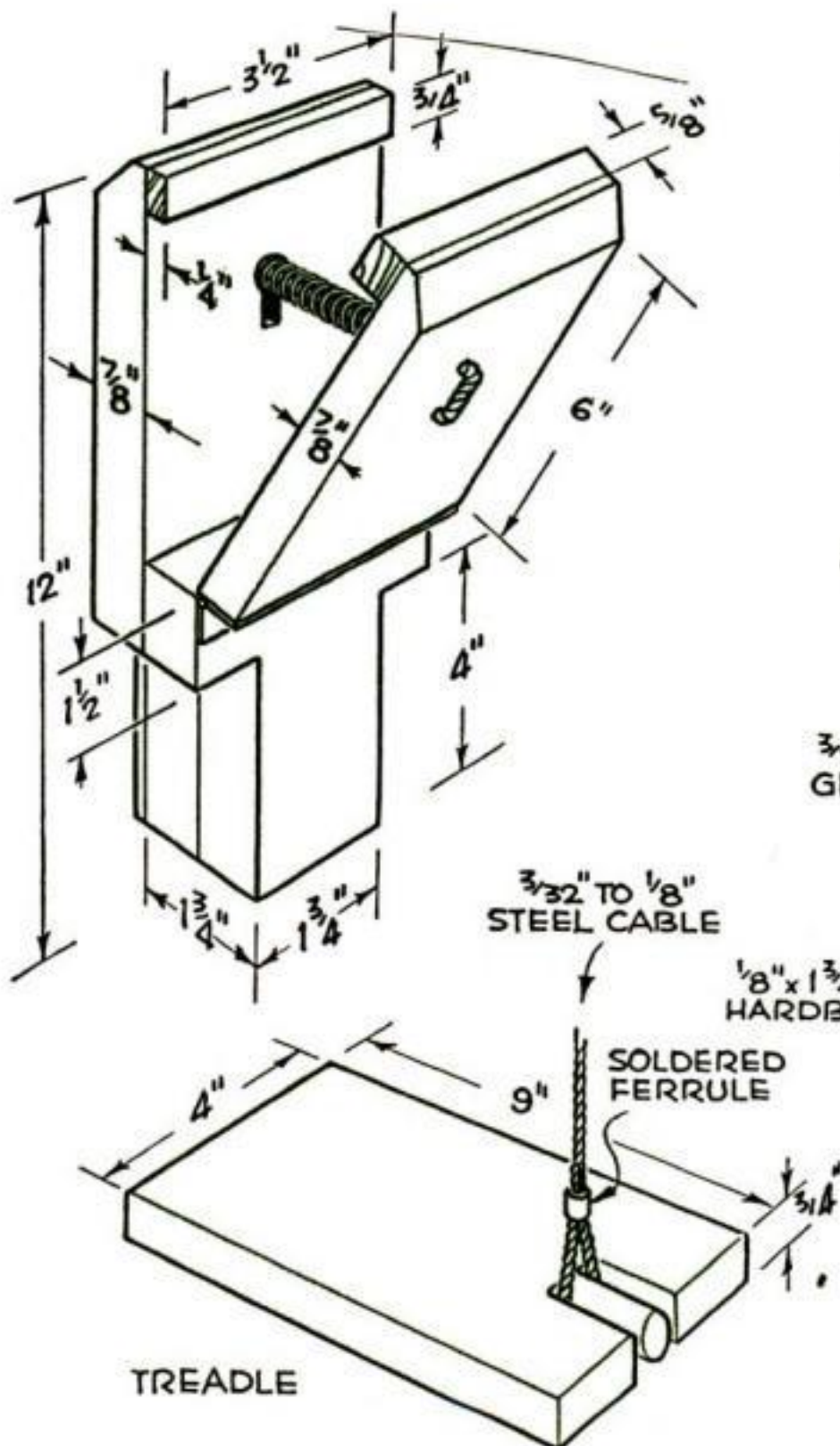
Quick-Acting

BORROW an idea from the old-time harness makers—make a foot-operated vise to speed work with small pieces that must be repositioned frequently. Clamped in a regular vise or bolted permanently to the workbench, it leaves both hands free.

You'll need five pieces of hard maple for the jaws and throat, a piece of hardboard to cover the cable slot on the

**...inexpensive
accessories
you can make
yourself**

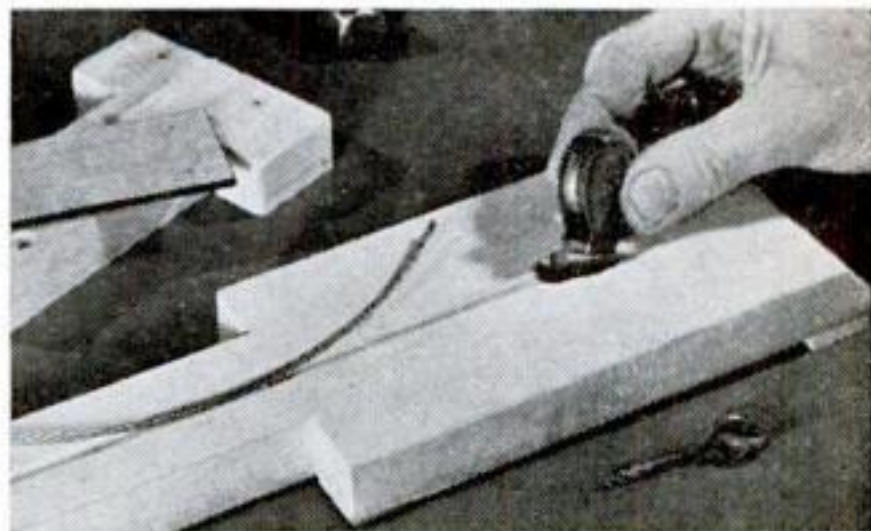
A PS Winter Workshop SPECIAL



Vise

throat, and a sturdy plank for the treadle. The line can be aircraft cable (from a surplus house), speedometer cable, chain, or a leather thong.

Adjust the cable length so that the bottom loop doesn't quite touch the floor when the jaws are closed. The unnotched end of the treadle rests on the floor. To improve grip, line the jaws with leather or rubber.—Walter E. Burton, Akron.



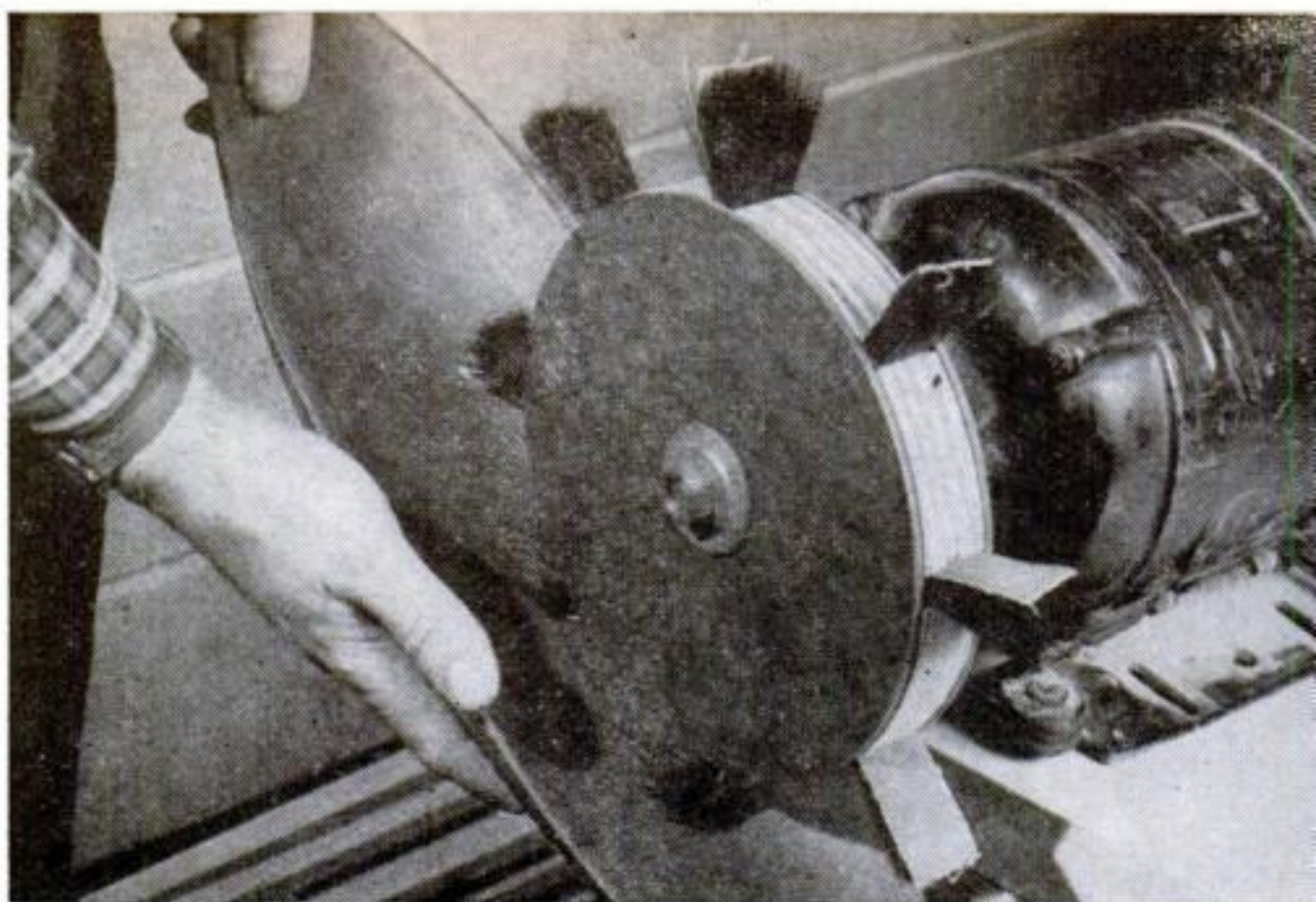
MOUNT PULLEY by jamming housing into mortise cut through stationary jaw. If furnace-control-type pulley is used, cut off eye (right foreground). Cable tension holds pulley in place.

CONTINUED

Contour Sander

A PINWHEEL of paint-brushes solves one of the peskiest chores in my shop: sanding the inside or outside contours of bowls, trays, and models. Eight brushes, whipping around a circle, force sandpaper strips to conform to any curved surface.

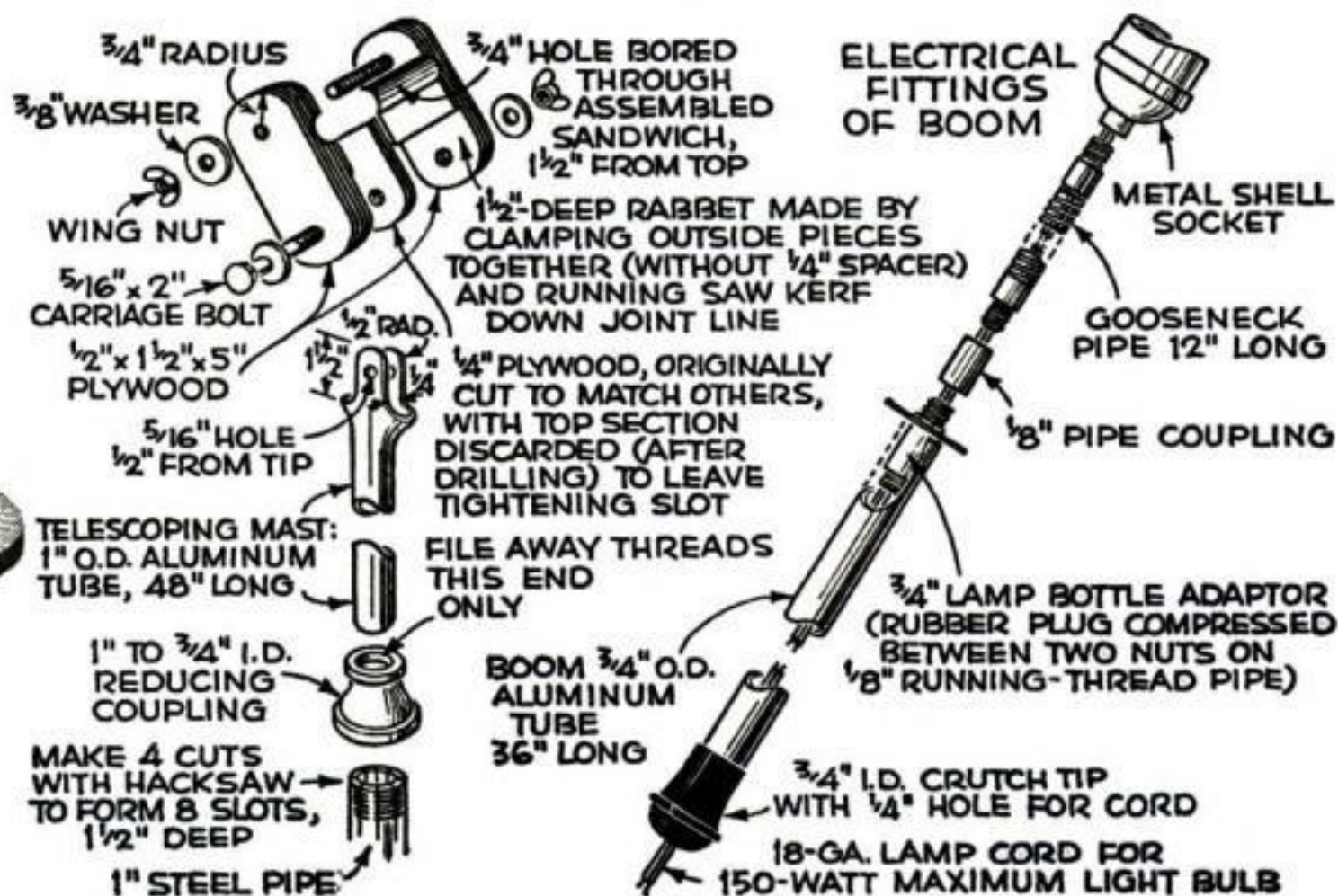
Buy cheap brushes with thick, fairly stiff bristles. Trim the handles off along the edge of the ferrules. To cut perfect 8" circles from the plywood and hardboard, rig up a trammel point for your band- or saber-

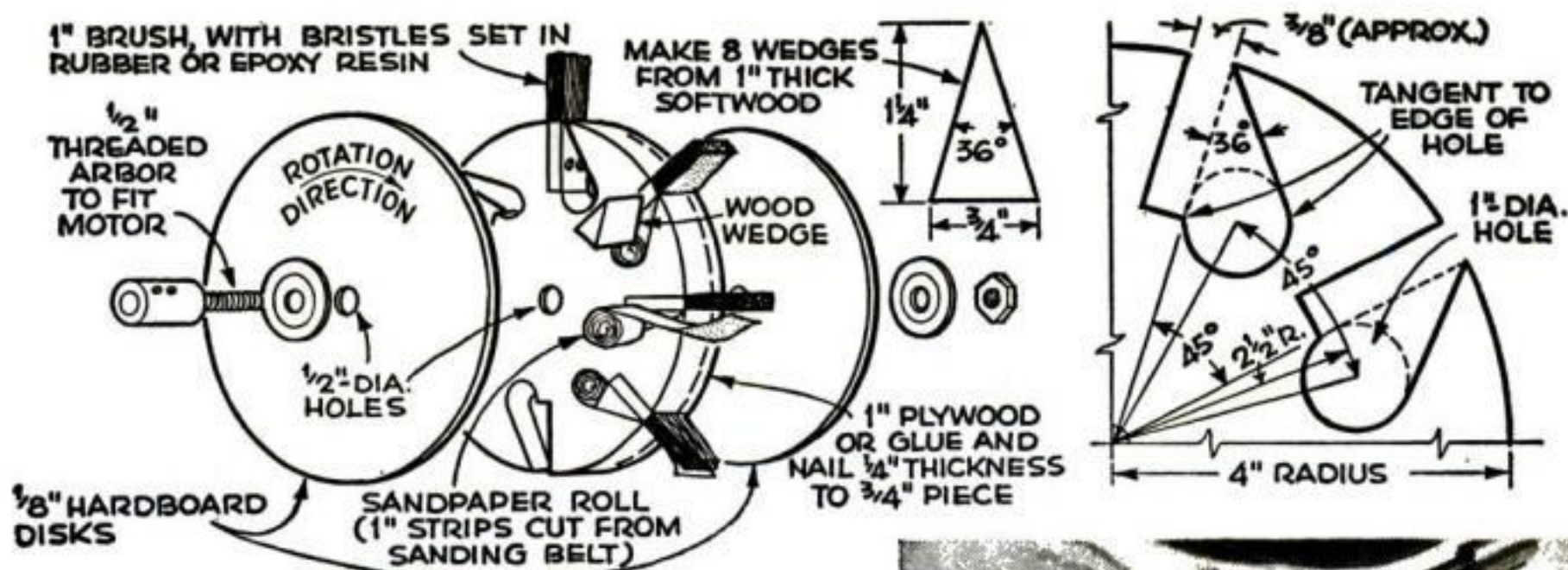


saw. Any $\frac{1}{3}$ - or $\frac{1}{4}$ -hp. motor will run the sander. Just be sure it doesn't turn faster than 1,750 r.p.m. Centrifugal force keeps the wedges tight.

Rolling Shop Light

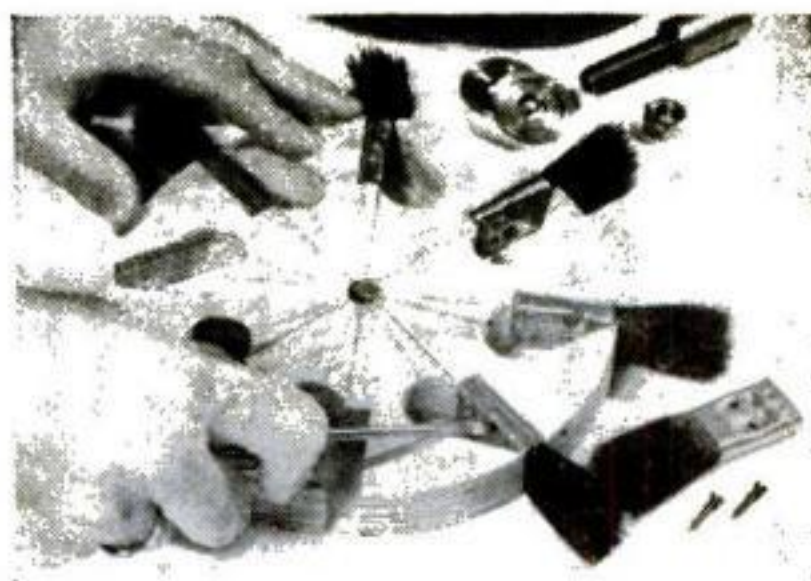
PORTABLE or roll-around tools need a lamp that can trail along. This one does. It puts light where you want it—from 1' off the floor to 12' in the air. And (though it has a 4' horizontal reach) it holds with the kind of steadiness you get only from a pipe anchored to concrete.





FASTEN EIGHT 1" BRUSHES to the core disk, using two No. 6 flathead screws, 3/4" long, for each brush. Drill the lead holes at a slight angle to permit easy access with the screwdriver.

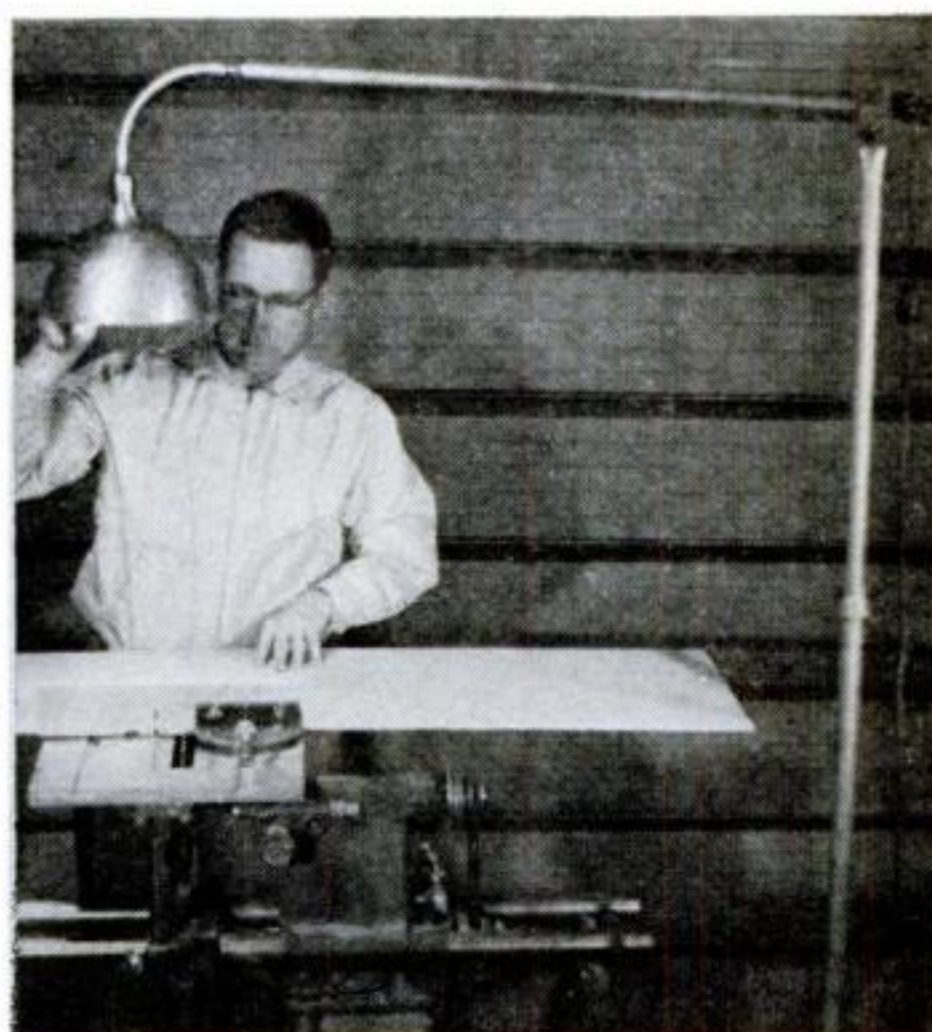
To renew worn paper, remove the arbor nut and one hardboard disk, and slide the wedge back far enough to draw out a fresh length.—*Jerry Beebe, Peru, Ind.*



The base is a disk of solid cement, liberally reinforced with chicken wire. It's studded top and bottom with plastic screw anchors for attaching the mast socket and casters. The fluted pattern on the top surface is a bonus from the unusual concrete form: a trash-can lid.

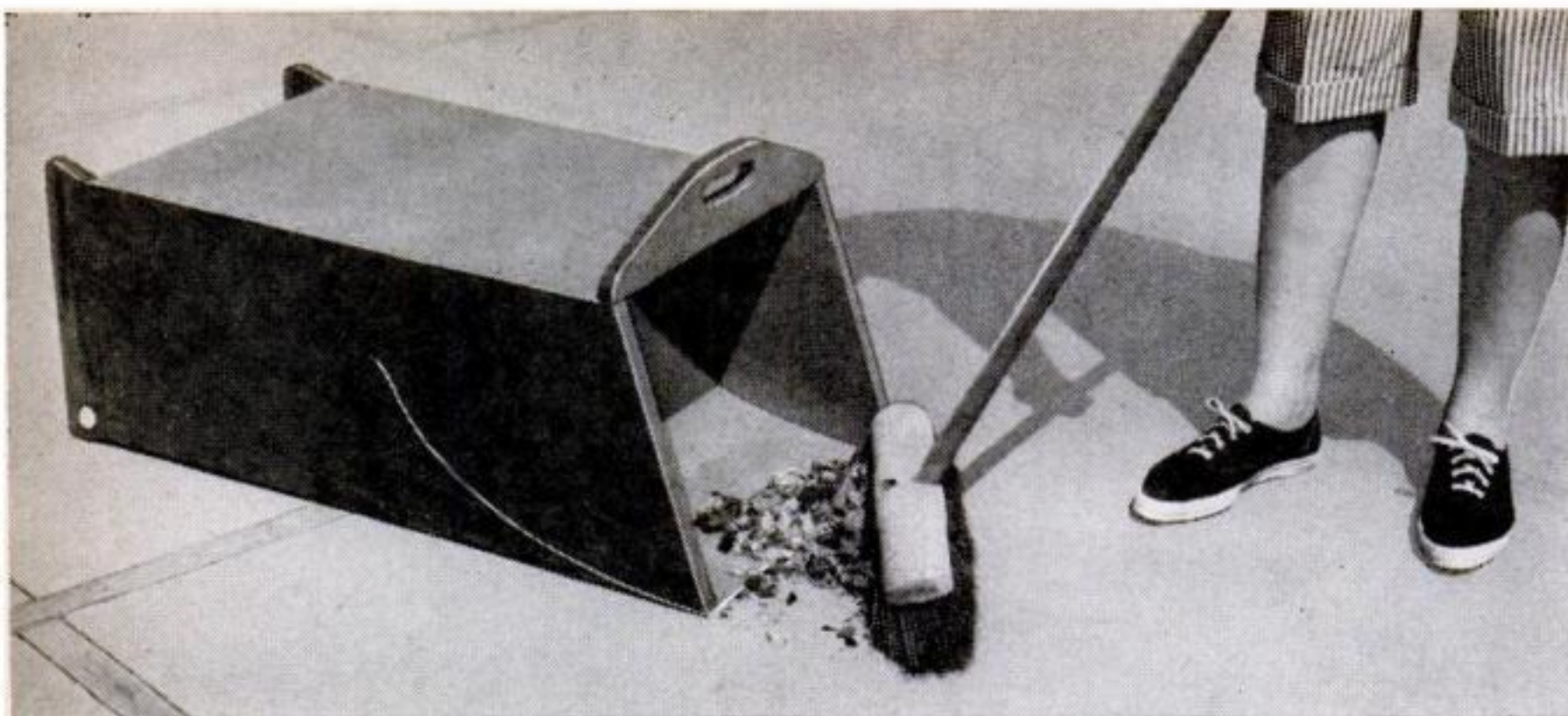
Such concrete disks are also ideal as standards for flagstaffs or signs, and bases for badminton nets, and yard-light posts. Even when not equipped with casters, they're easy to move: just tip them up and roll them on edge.—*Ernie E. Hickman, Farmington, Mich.*

HOW TO CAST THE BASE



CONTINUED

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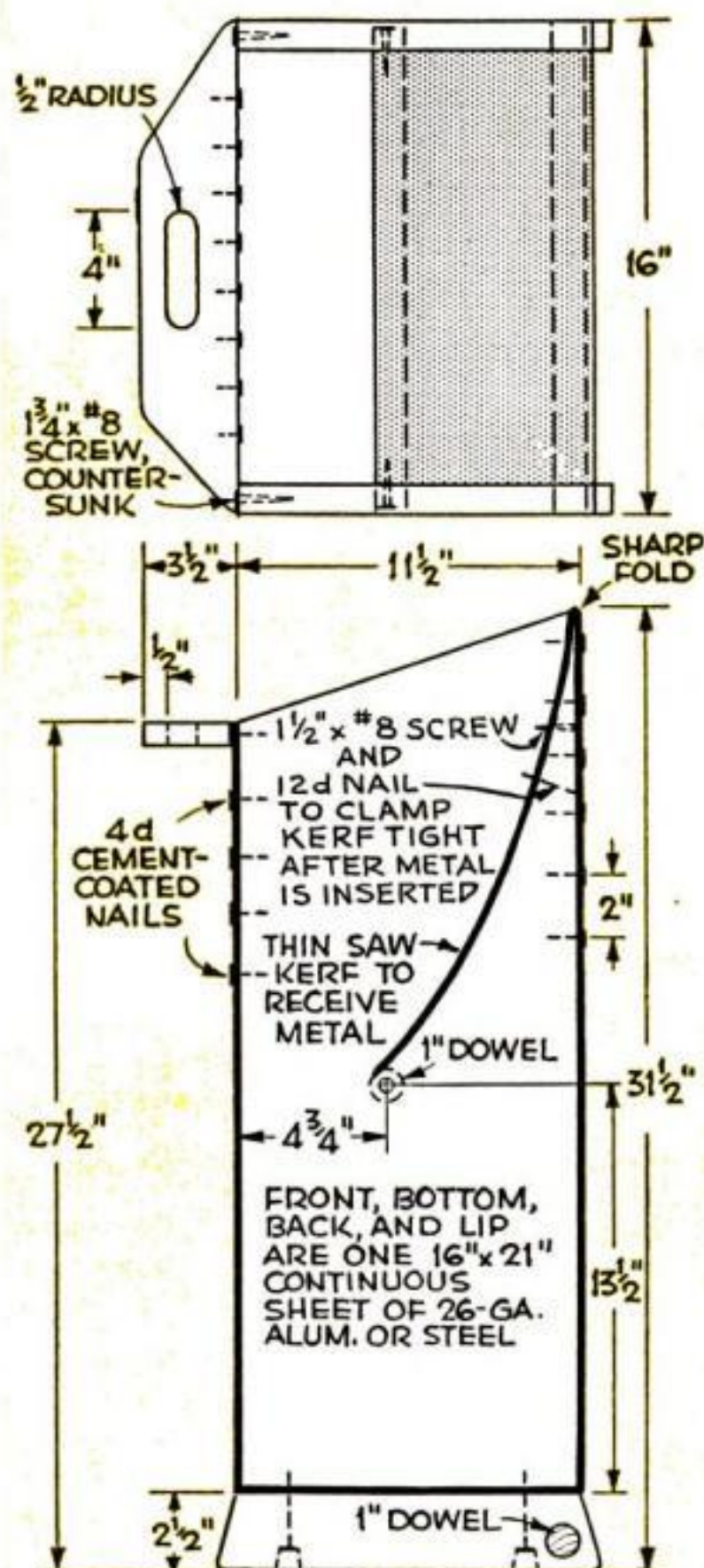
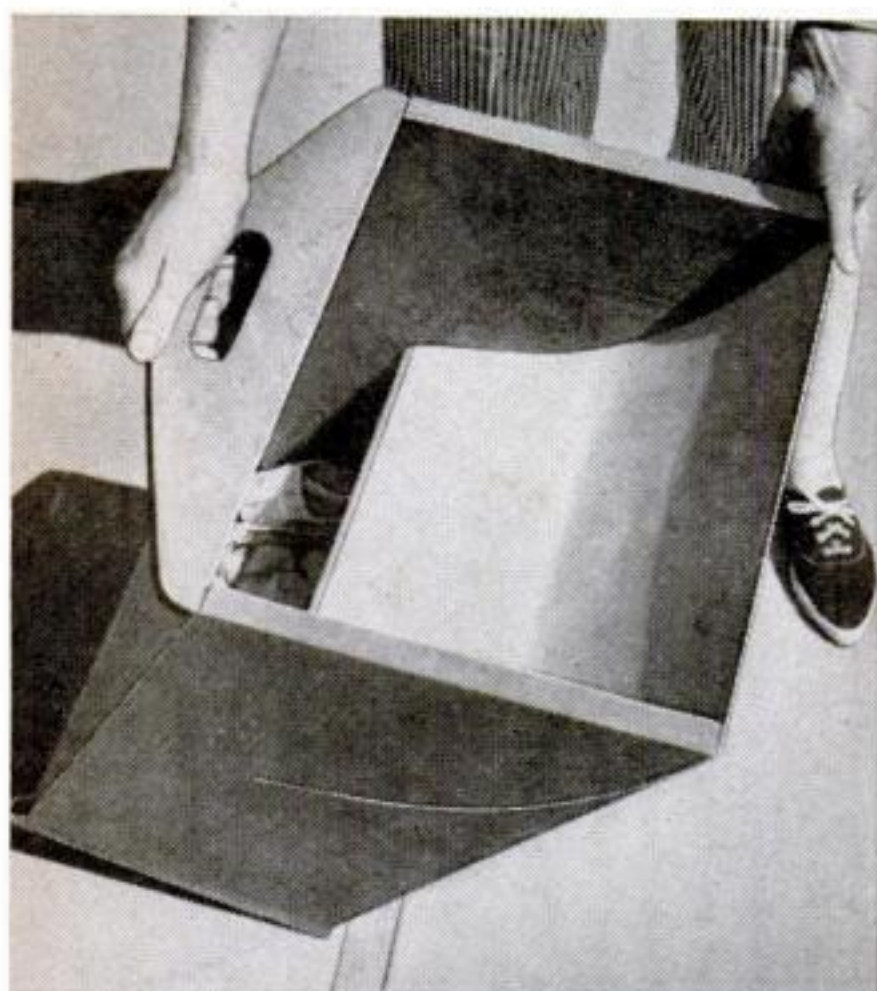


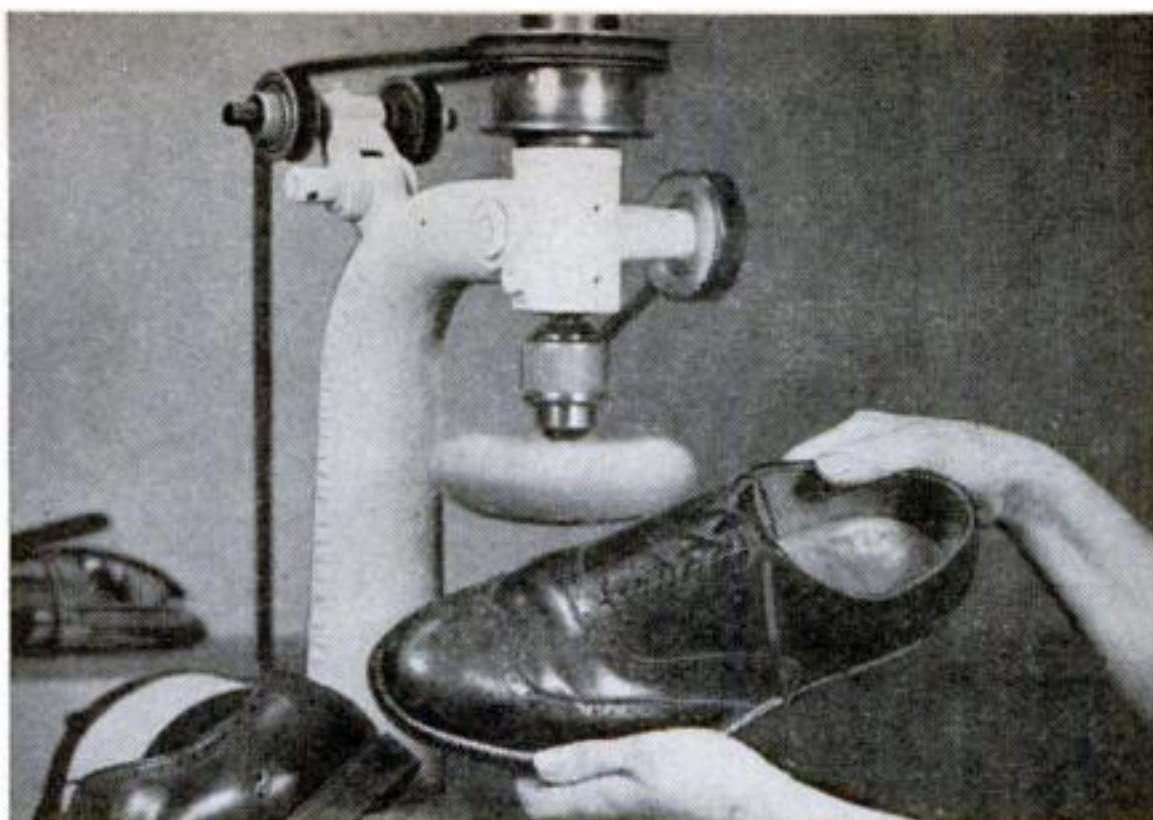
Dustpan-Bin

LYING down, this litter-eater presents a big metal mouth into which you can sweep shavings and dirt. Tipped up, it swallows the trash, holding up to a bushel in its semiconcealed maw. On the next tip, the lip prevents spillage.

Both sides come out of a 6' 1-by-12 (preferably redwood). The runner feet and front handle are cut from a 4' 1-by-4; they're attached after the metal is fastened into the kerfs and around the edges of the sides.

The full-width bottom dowel provides a handle for upending the bin to dump it.
—Bob Gilmore, Sonoma, Calif.





Shop Tips

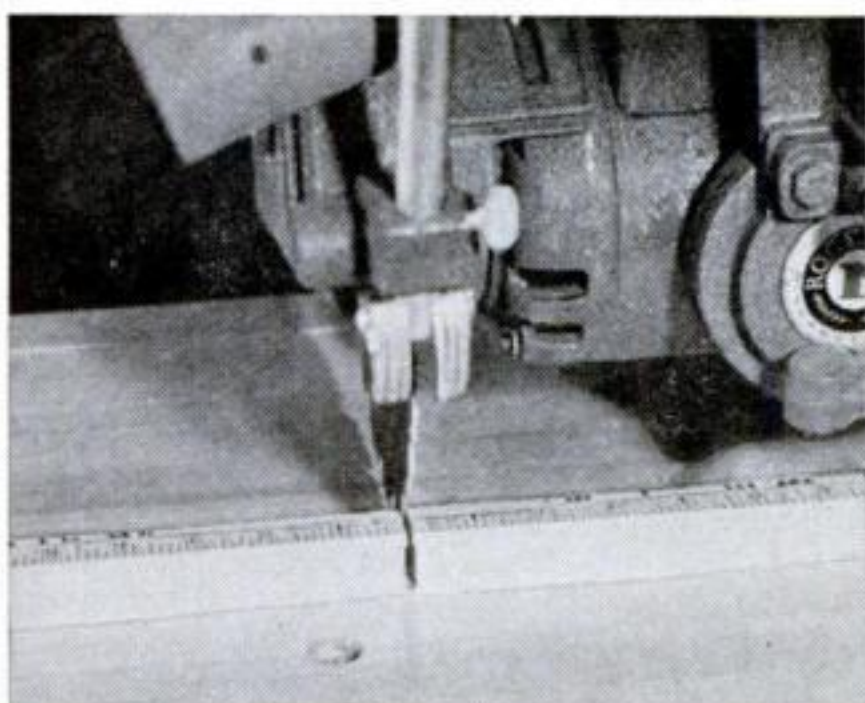
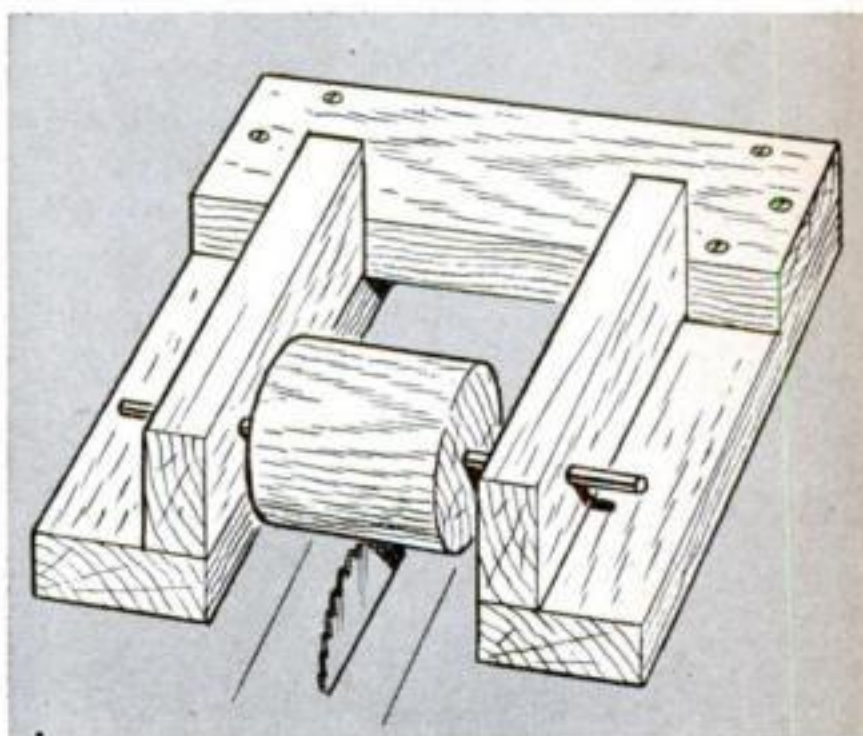
FROM PS READERS

Drill Press Used as Shoe Shiner

SHINE the family's shoes in a jiffy. Brush on wax polish the usual way; then buff by pressing each shoe against a wool polisher mounted in the drill press, as shown at left.—*Benson E. Hall, Evanston, Ill.*

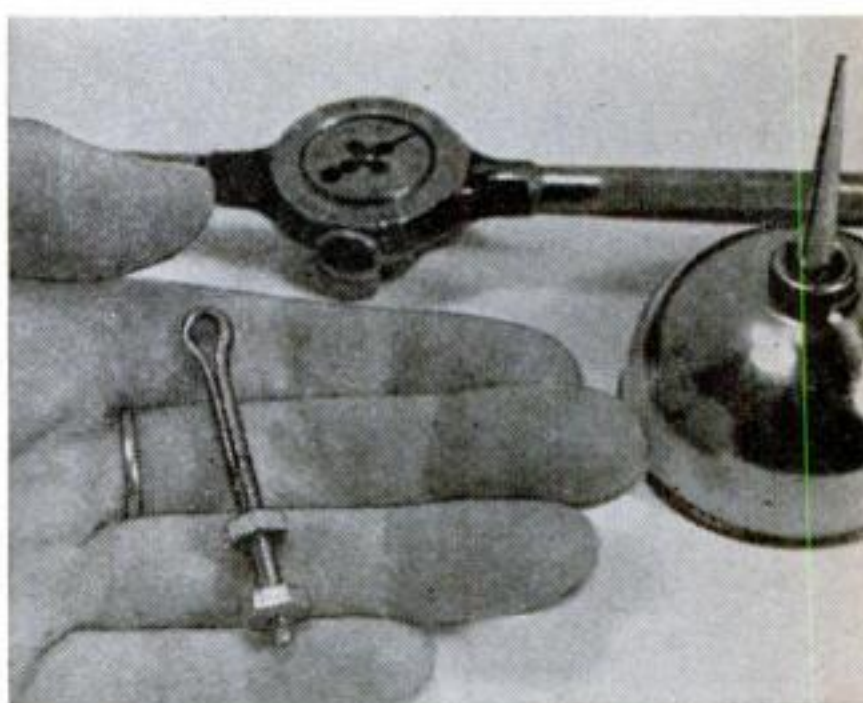
Rounding Wood on a Table Saw

You can turn out wood cylinders on the table saw with this jig. Dimensions depend on the size of cylinder you need. Drill a hole through the center of the block, and mount the block on a rod between flanges. Start with the blade just high enough to trim the corners. Raise the blade a little at a time as you move the jig back and forth. To smooth up the straight passes, slide the jig from side to side. The rod hole provides perfect axle holes if you're slicing the finished cylinder into wheels for wooden toys.—*Walter Fehlberg, La Crosse, Wis.*



Cutoff Scale for Radial Saw

IF A radial saw lacks a cutoff scale, make one from a double-faced yardstick. Cut it in two and glue the halves to the top edge of the fence, with graduations numbering from the kerf. Plane the edges flush with the fence after the glue has set.—*Ben Quan, Ottawa.*



Make Your Own Eyebolts

COTTER pins of steel or brass can serve as small eyebolts for mechanical repairs if you thread the ends. One advantage is that the legs spread easily for inserting a welded ring or wire loop. The $\frac{1}{8}$ " size takes a perfect 8-32 thread.—*Robert Micals, Freehold, N.J.*

Make Wooden Gears?

SURE. HERE'S HOW

WOODEN gears for home-built mechanisms are entirely practical. They're easy to make—in any size you need. They cost only a fraction of what you'd pay for metal spurs and pinions.

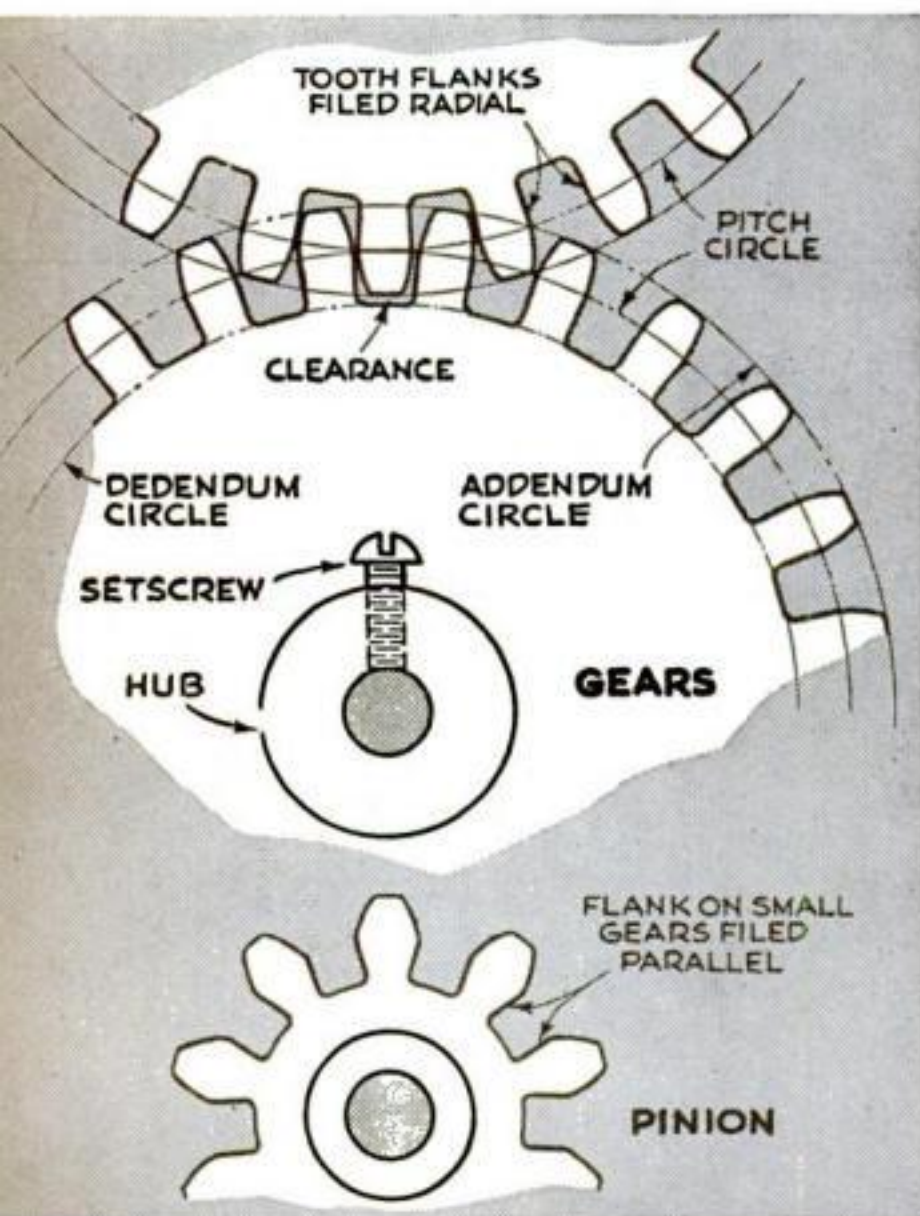
There is a precedent. Prior to 1837, most American clockmakers used wooden gears. Some of the clocks they made are still keeping time, even though many

gears cut from solid wood have become ellipses due to shrinkage across the grain over the years. For a serviceable wheel that will carry a load, it's safer to glue up disks by fitting six or eight segments together like cuts of pie. This reduces warpage, minimizes shrinkage, and makes the grain run lengthwise in all teeth.

A jig makes gear-cutting almost automatic. The one illustrated has a semi-circular dividing head pivoted on a wood slide equipped with locks and an infeed stop. A piece of coarse sandpaper glued on the dividing head keeps the gear blank from slipping during the indexing operation. A wingnut holds the blank firmly against the sandpaper.

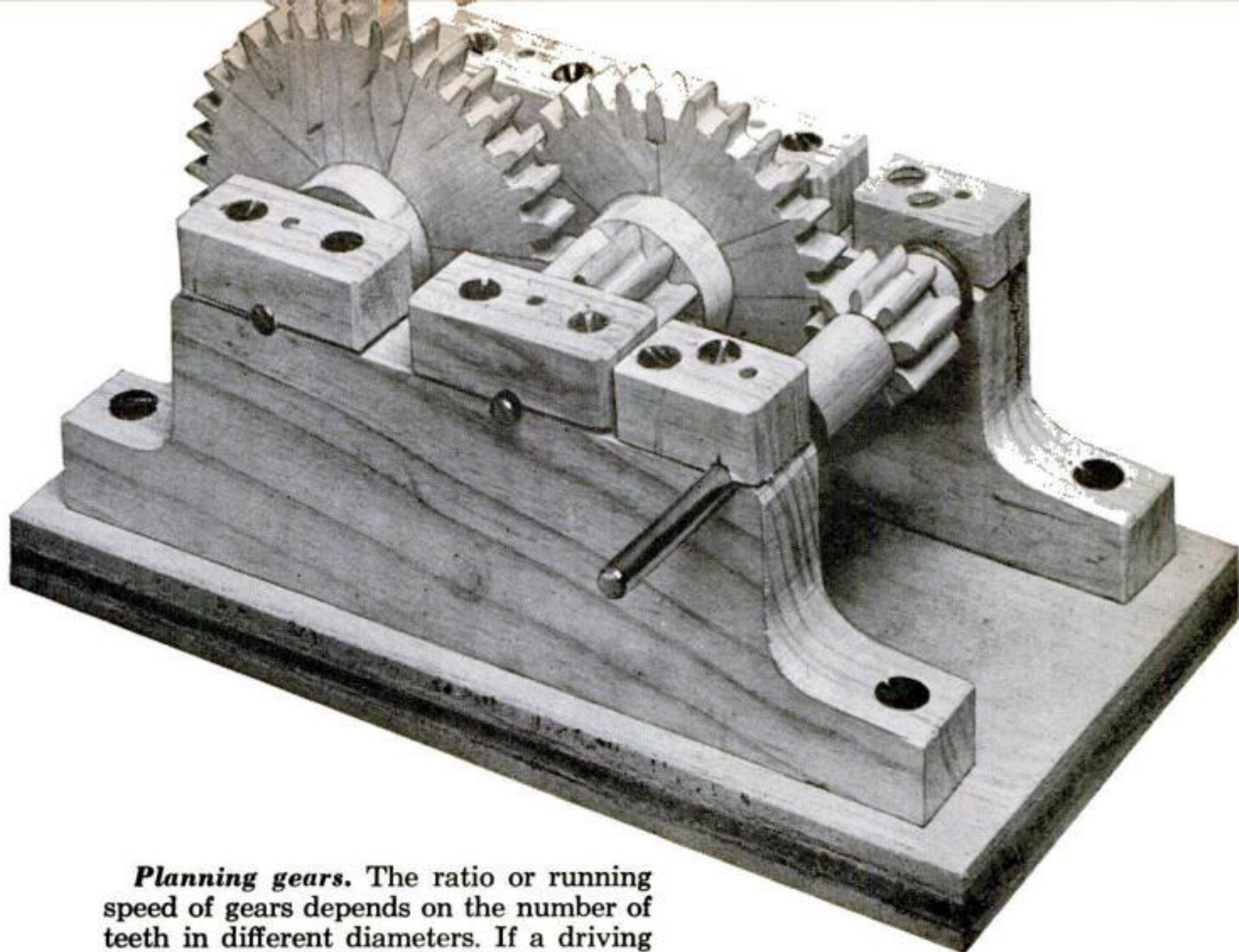
The head is calibrated with a paper scale divided to suit the number of teeth in the cogwheel. A single scale can be used for several gears if the teeth are multiples of each other. For instance, a scale for 60 teeth would also do for 30-, 20-, and 15-toothed gears. Attach the scale to the dividing head with tape or rubber cement.

SIX OR EIGHT SEGMENTS, shaped like cuts of pie, are fitted together to form a blank disk. Trim segments on sander, making corrections in the angle by adjusting the miter gauge very slightly until pieces fit perfectly.



PARTS OF GEAR TEETH. In theory, the pitch circles of two gears should meet when teeth are meshed properly. Clearance is obtained by the difference between the addendum of one gear and the dedendum of a mating gear. Note how the flanks of pinion teeth are shaped.





Planning gears. The ratio or running speed of gears depends on the number of teeth in different diameters. If a driving gear has 30 teeth and a smaller driven gear 15, the driven gear will turn twice as fast as the driver. If the driven gear is used to drive, the larger gear will turn half as fast. The effect is similar to the step-up or reduction obtained by combining pulleys of different diameters.

Gears are basically wheels that roll against each other. Visualize two wheels or disks with their edges pressed together. Friction would cause one to drive the other, but they'd slip under even moderate load. By adding teeth, slippage is

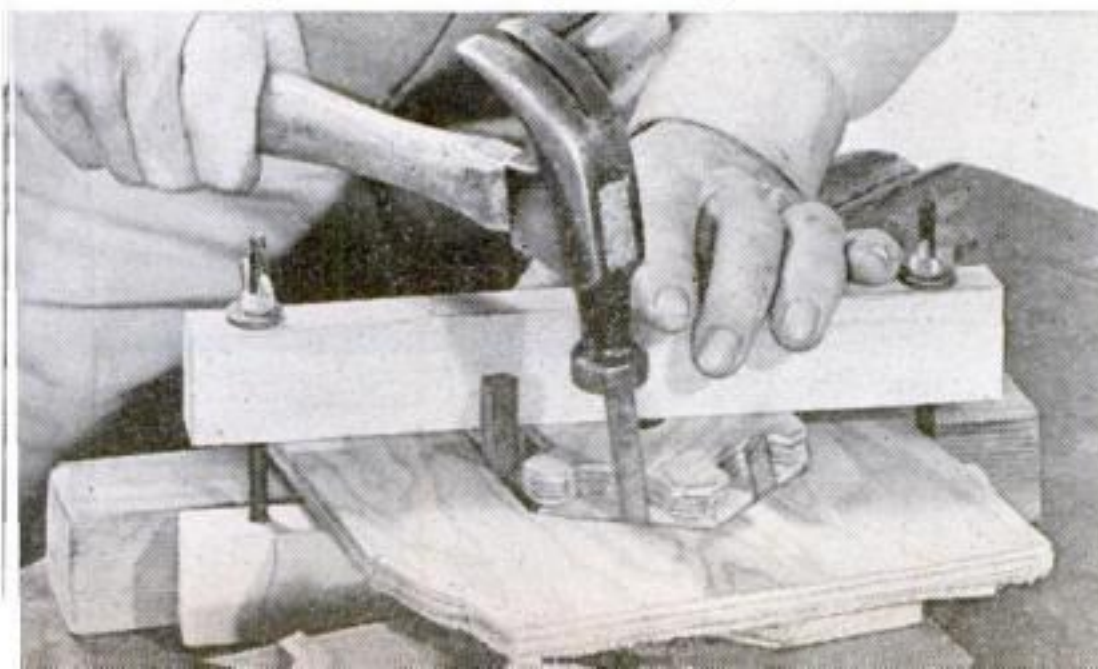
eliminated and power can be transmitted from one wheel to the other.

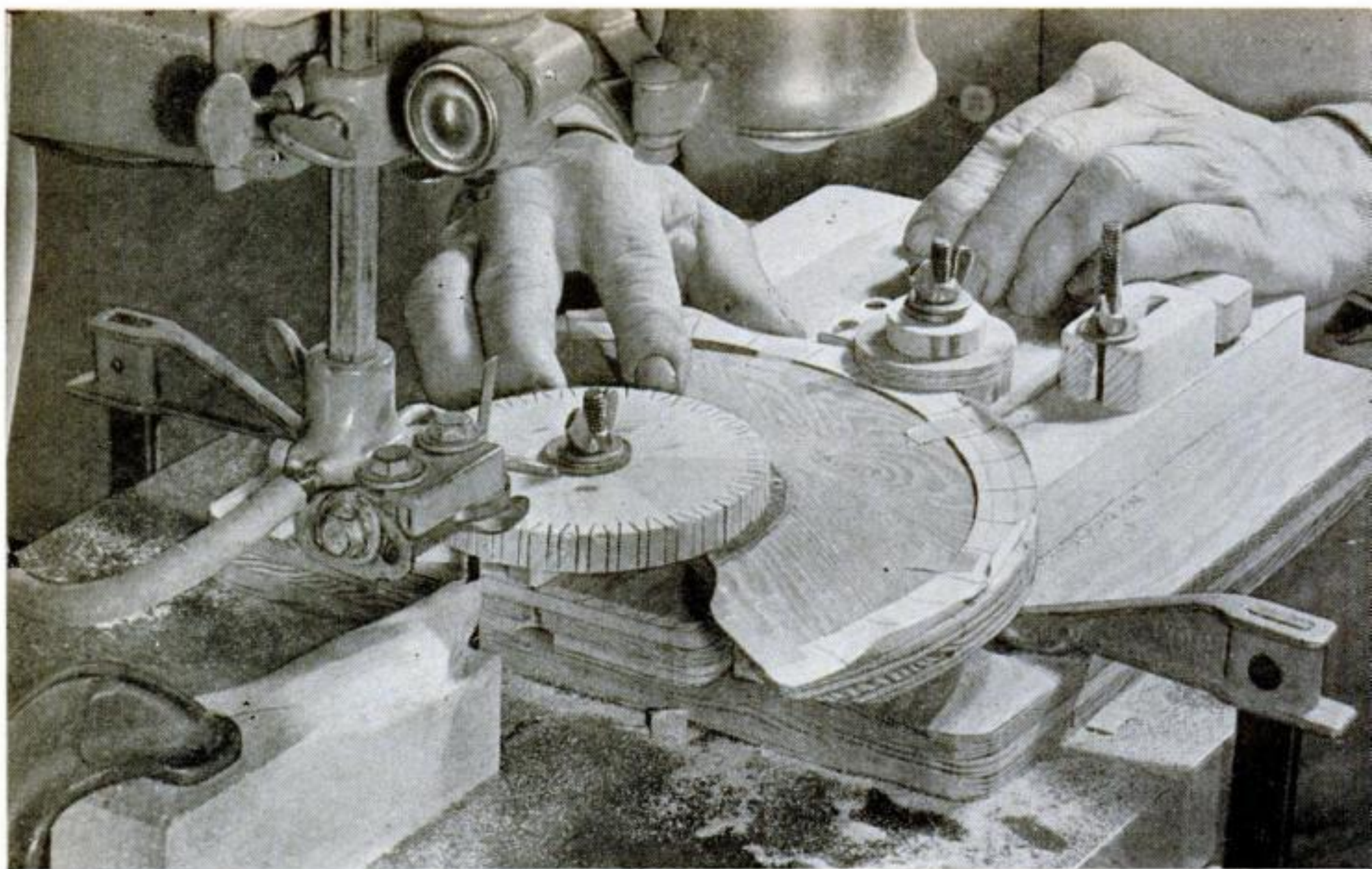
In technical lingo, the pitch diameter is the actual working diameter of the gear in mesh with another gear (see drawing). This diameter is about in the center of the teeth. The larger outside diameter created by the tips of the teeth is called the *addendum*, and the smaller diameter created by the bottom of the spaces between the teeth is the *dedendum*. The circle created by the pitch

CONTINUED

CLAMPING JIG for gluing blanks can be made by cutting a six- or eight-sided hole in plywood. Assemble segments in hole and drive wedges into jig to force them together. Clamp strips and notched pads keep blank flat.

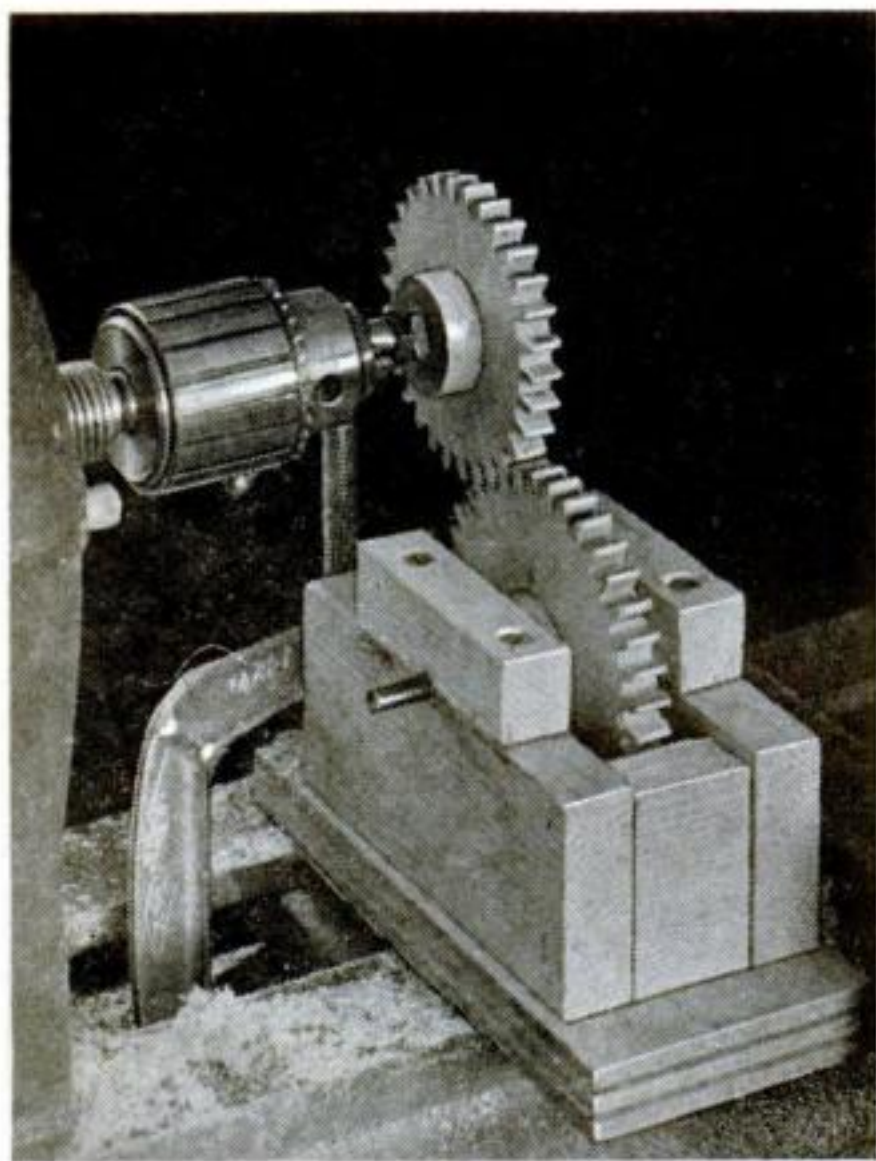
SANDING JIG makes blank perfectly round. Bore shaft hole in blank and slip it on a dowel pressed into a block of wood clamped to the sander table. Rotate the blank against the sanding disk to grind it to size.





DIVIDING HEAD, with gear blank fastened to it, is indexed by paper scale taped to its edge. Wingnut at rear of head locks it while cut

is made; stop block at rear left limits depth of cut. Slotted block, clamped to table in foreground, keeps saw blade from flexing.

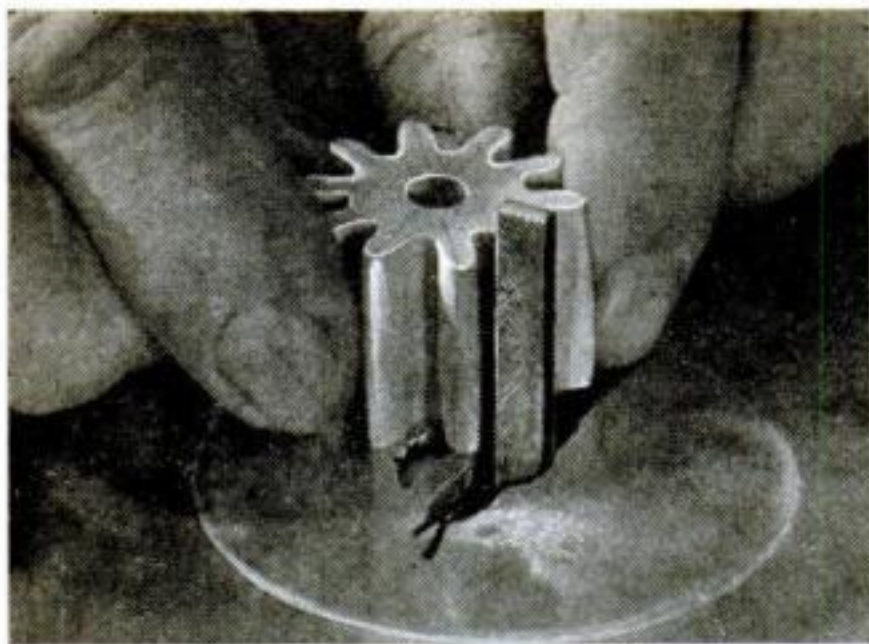


GEARS ARE RUN IN, after teeth have been filed round, until they mesh smoothly. Crude block supports driven gear; drive gear is chucked in lathe. Drill press or motor could be used.

diameter is the *pitch circle*, and it is on this that gears are classified. A 10-pitch gear has 10 teeth for each inch of pitch-circle diameter. So, a 10-pitch gear 3" in diameter would have 30 teeth; a 2"-diameter gear, 20, and so on. A 10-pitch gear will mesh with any other 10-pitch gear, regardless of differences in diameter because tooth spacing per inch of pitch circle is the same.

A good size for wooden gears is 10 pitch, with teeth $\frac{1}{4}$ " long and about $\frac{5}{32}$ " wide. These proportions should fit most home-built mechanisms, and there is more tolerance for slight errors in cutting.

Making gear blanks. Almost any fine-grained hardwood is suitable for gears, but seasoned hard maple is best. Cut identical wedge-shaped segments from $\frac{3}{8}$ " stock and smooth their meeting edges on a sanding disk. With a few test cuts, the miter gauge can be set up to sand perfect-fitting segments ready for assembly with a moisture-resistant glue. The clamping jig illustrated makes use of thin wedges to force the sections together. Wood strips, drawn together with bolts and wingnuts, press on plywood



TEETH ON SMALL PINIONS can be filed to shape after cutting freehand. Divide blank into number of teeth required for diameter and pitch, draw in teeth and cut to pencil line.

viding head to the starting point. Tighten the blank, lock the head, and resume cutting until one side of all teeth are cut. Reset the dividing head to the starting position and turn the blank over to cut the opposite side of the teeth. Adjust the head so that the first cut will form a tooth $\frac{5}{32}$ " wide at the pitch circle. Lock the blank and proceed with the cutting until all teeth are formed. Remove the blank from the jig and cut out the waste between the teeth freehand, nudging it lightly against the jig or bandsaw blade to trim close to the dedendum circle.

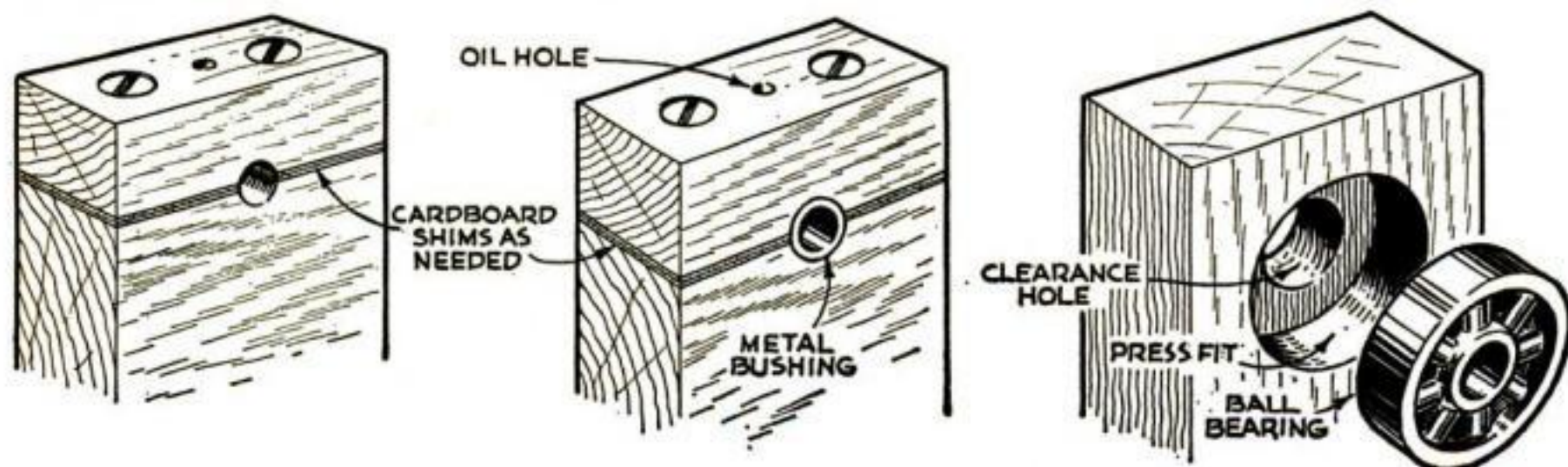
Further shaping of the teeth depends on the diameter of the gear. All tips must be rounded, but gears with less than 40 teeth require some touching up on the flanks (see drawing) to make them radial. A file used in the jigsaw makes short work of finish-forming teeth.

Making pinion gears. Small gears, having few teeth, are easy to make without the jig. A $\frac{3}{4}$ " length of $\frac{3}{4}$ " to 1" hardwood dowel (depending on the size pinion required) makes a fine blank. Draw pitch

and dedendum circles on the ends of the dowel, and lay out equal divisions on the outside diameter or addendum for the number of teeth to be cut. Draw in the teeth and cut them freehand. Finish shaping the teeth with a file until flanks are parallel.

Running in the gears. Glue disks to one or both sides of the gear for hubs. Setscrews can be threaded into the wood for mounting the gears on shafts. Run in *pairs* of gears by mounting one on a shaft in a boxlike support and driving the other on a shaft chucked in a lathe or spare motor. Clamp the box in a position that will permit the teeth to mesh deeply, yet turn freely by hand, and turn on the motor. After about 15 minutes of running, or when the gears begin to run quietly, move the box a bit to mesh the teeth deeper. Apply light grease and run the gears together for another 15 minutes, and they should be ready for use. Initial running in can be speeded by applying powdered abrasive to the gears while they rotate against each other. Clean off the abrasive after running in, so that it won't continue to wear the teeth.

Bearings for gear shafts. For many applications well-greased pillow blocks cut from hardwood will support gear shafts and let them turn freely. Brass or bronze bushings fitted in the pillow blocks will improve operation. Ball bearings, which can often be bought cheaply at salvage stores, are easy to install and will last almost forever. Adjust an expansive bit to bore a tight-fitting socket hole in the wood frame, and press the bearing into it. Another hole bored in the center of the socket hole will provide clearance for the inner race of the bearing, and permit the shaft to pass through the frame. ■ ■

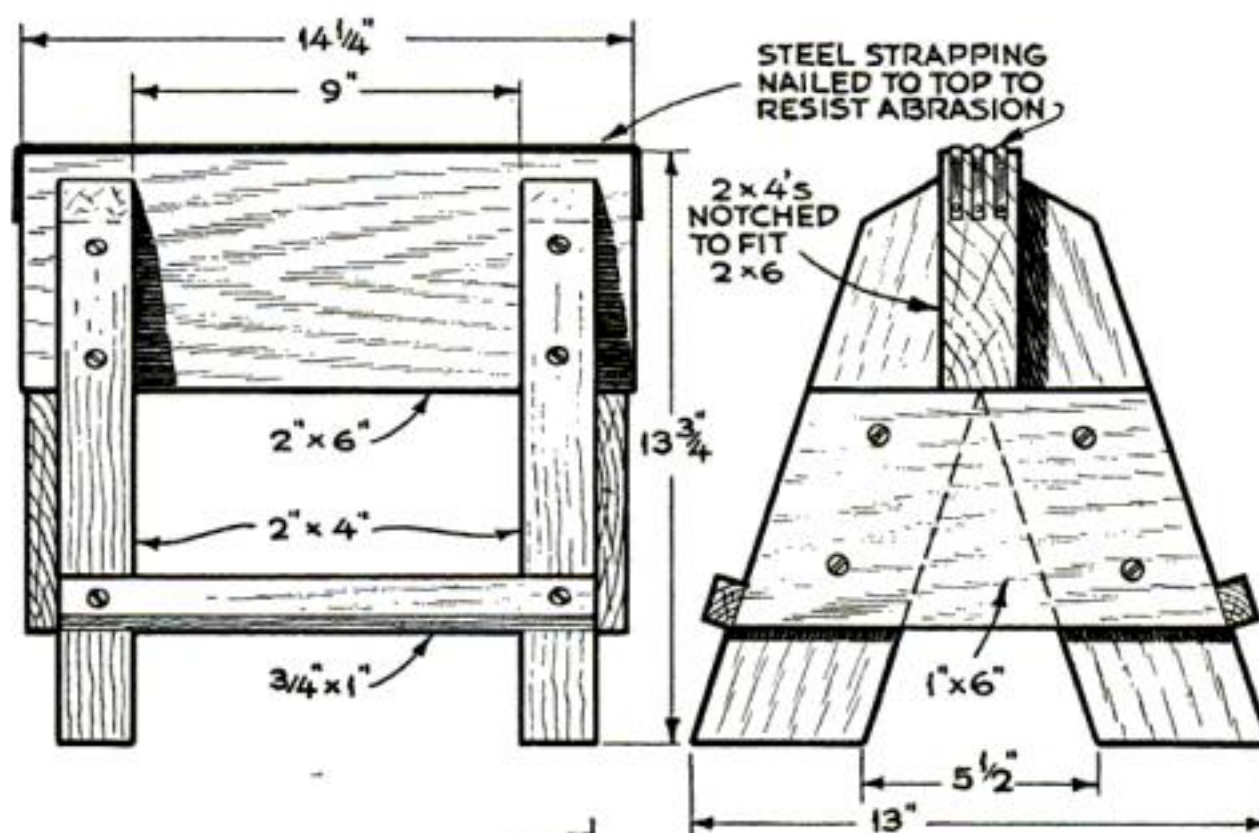
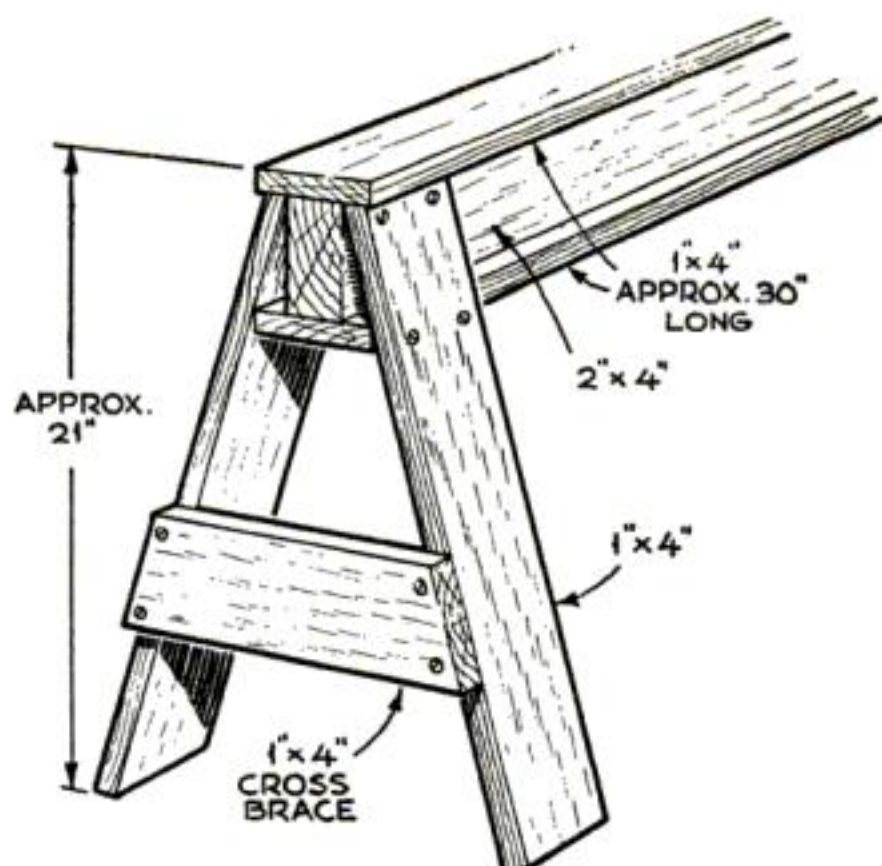


EASY-TO-MAKE BEARINGS support gears, let shafts turn freely. Socket hole for ball bear-

ing must be drilled slightly undersize, and the bearing pressed tightly into it.

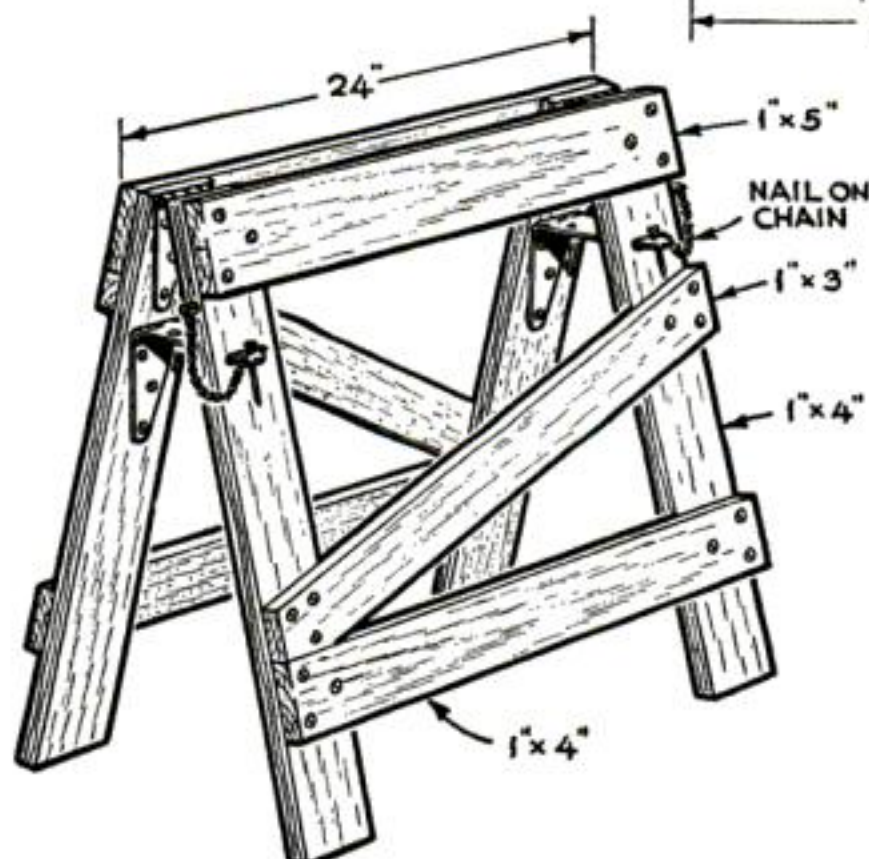
3 Ways to Build a Sawhorse

FAST HORSE. Built almost as quickly as you can say Man o' War, this one can be put together with scraps. There's no fussing with bevels; just nail a one-by-four on both edges of a two-by-four. Leg angle is formed automatically. Secure the legs with a cross brace at each end.—*H. R. Sault, Altadena, Calif.*

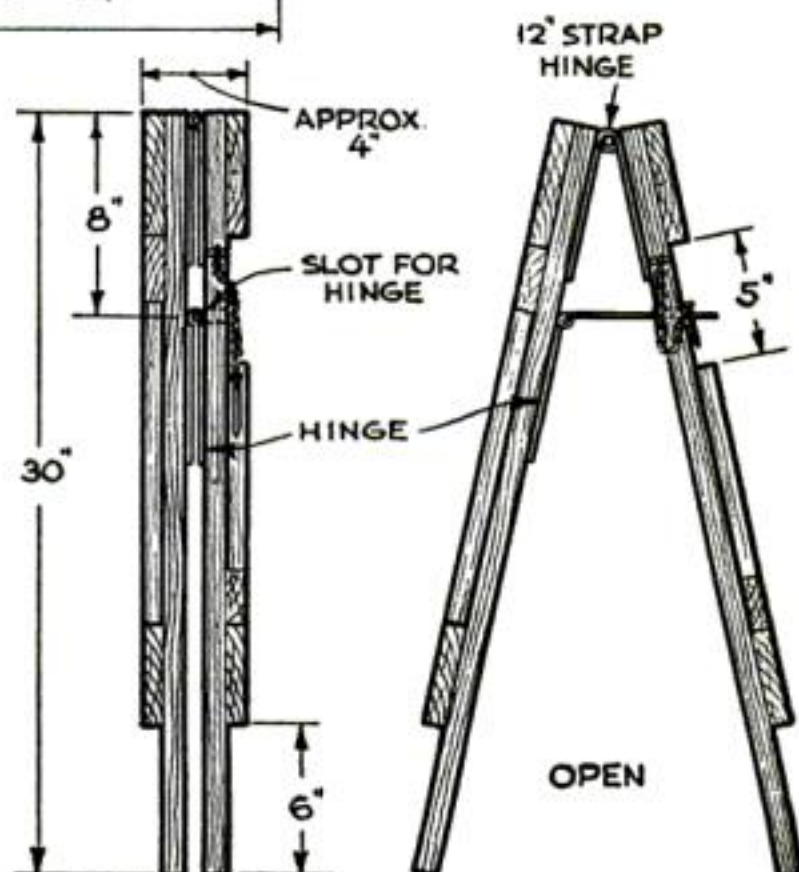


STRONG HORSE.

Four squat legs and a 6\"



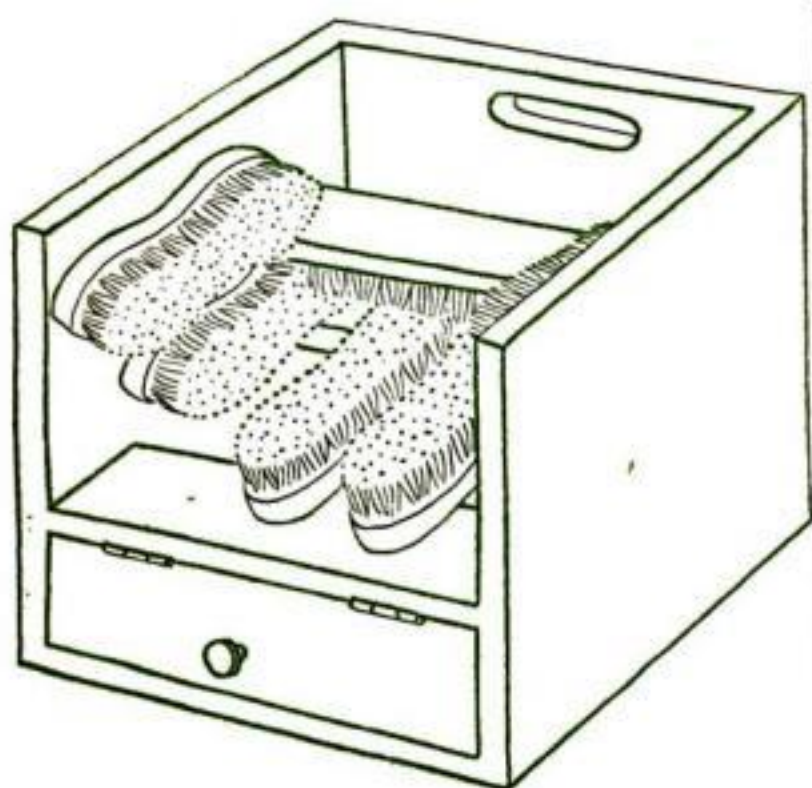
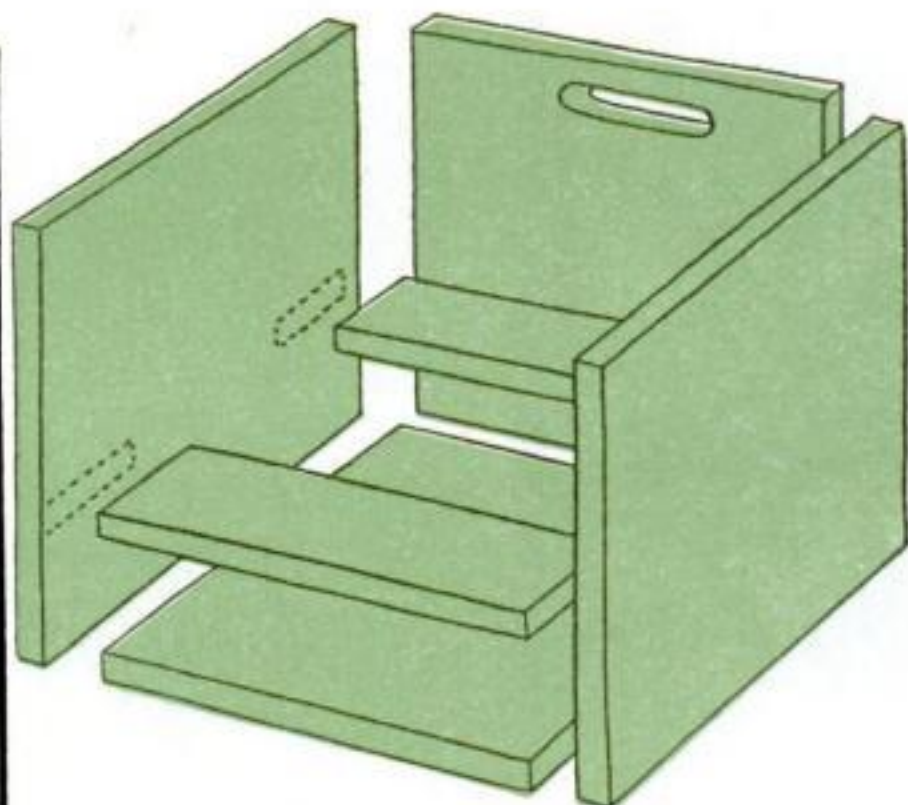
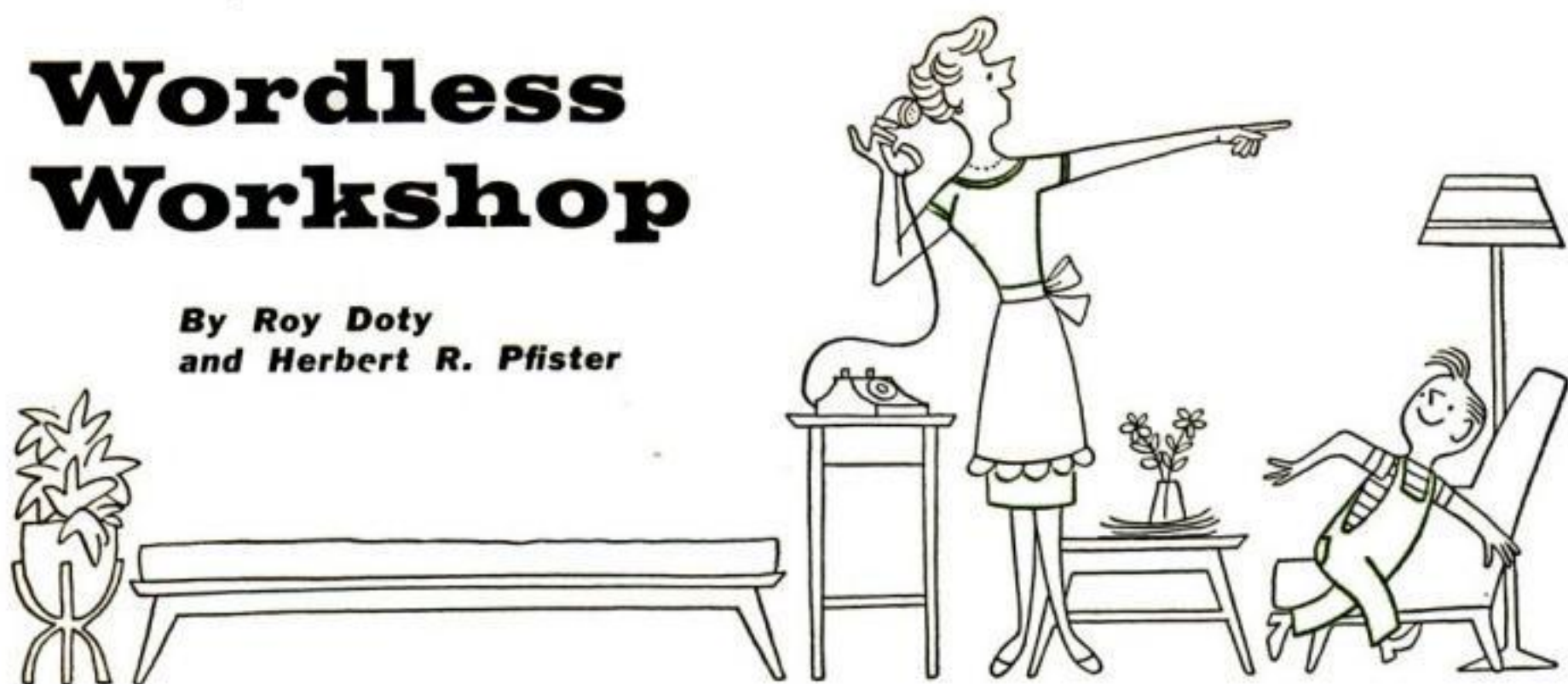
SKINNY HORSE. This one, made of 1\"

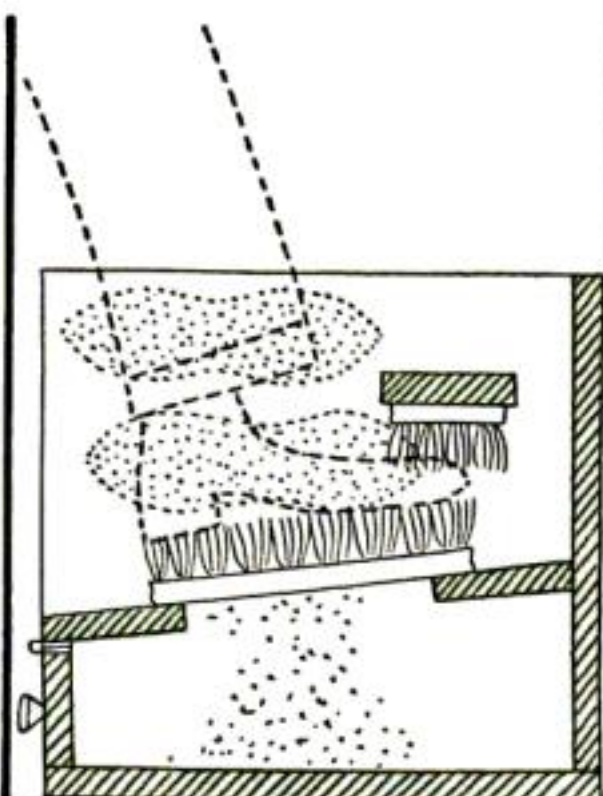
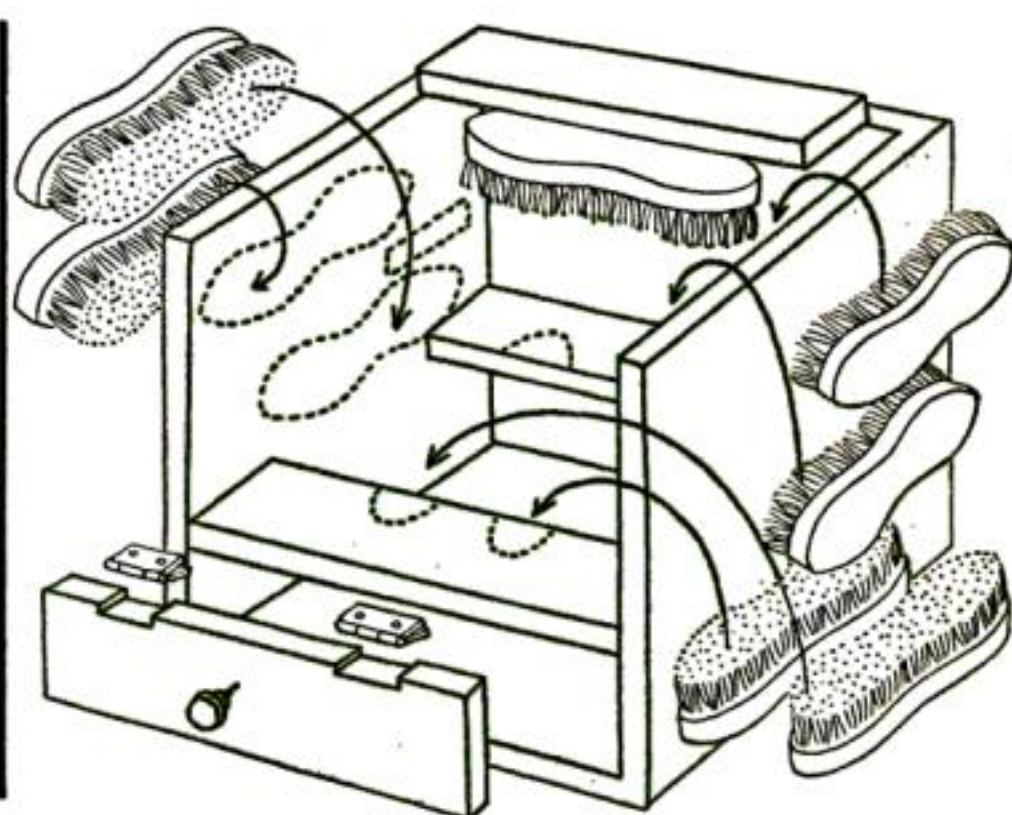
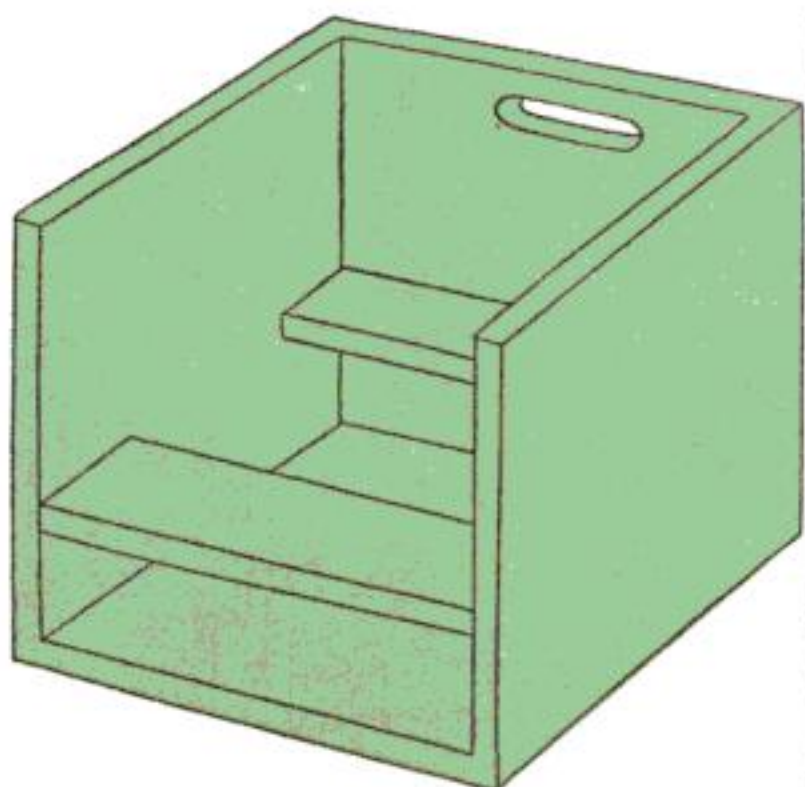
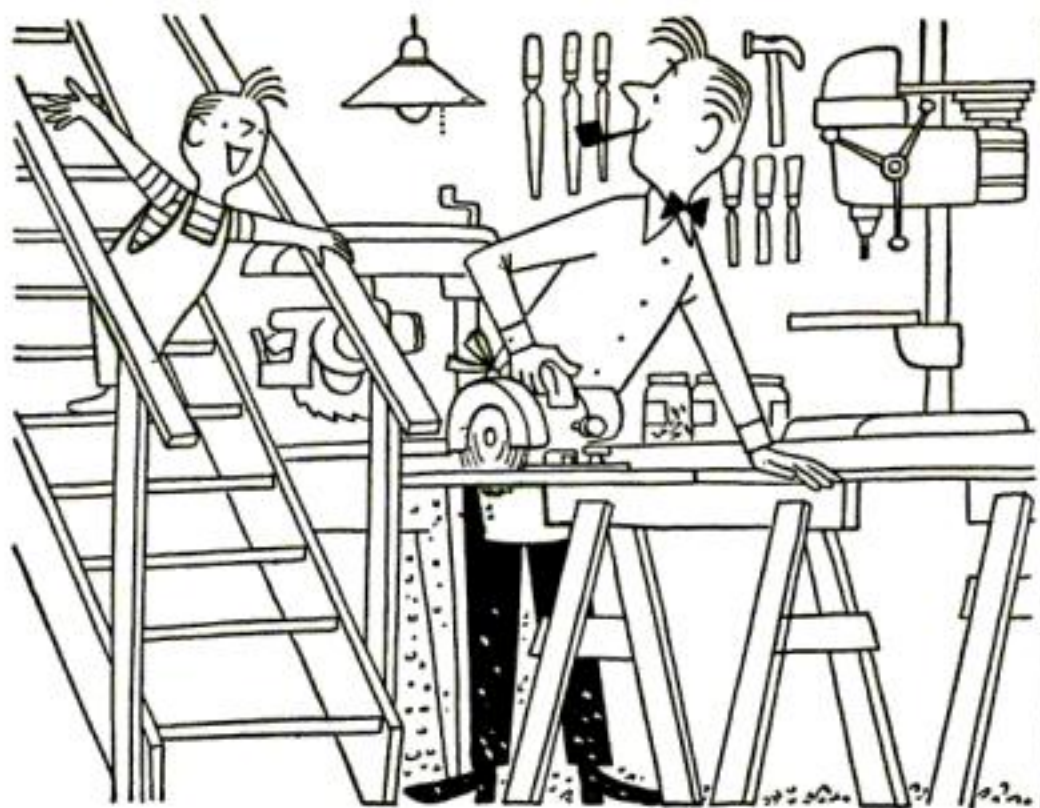


fold planks. An extra hinge at each end serves as a cross brace when inserted in a slot and pinned with a nail.—*M. J. Kamenar, Cleveland, Ohio.*

Wordless Workshop

By Roy Doty
and Herbert R. Pfister



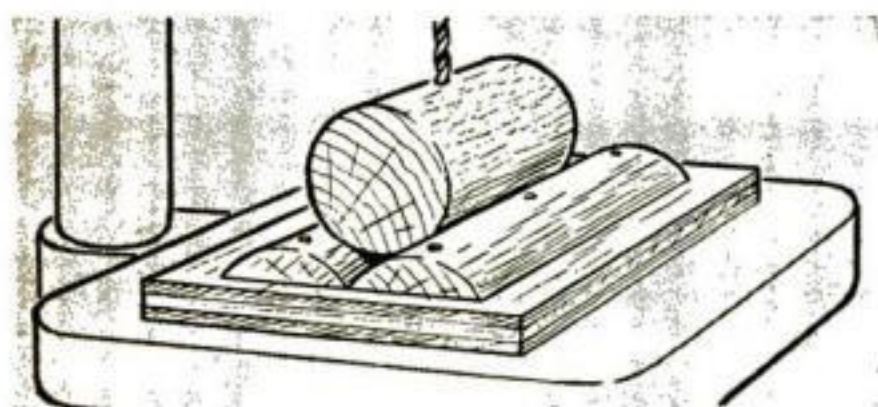
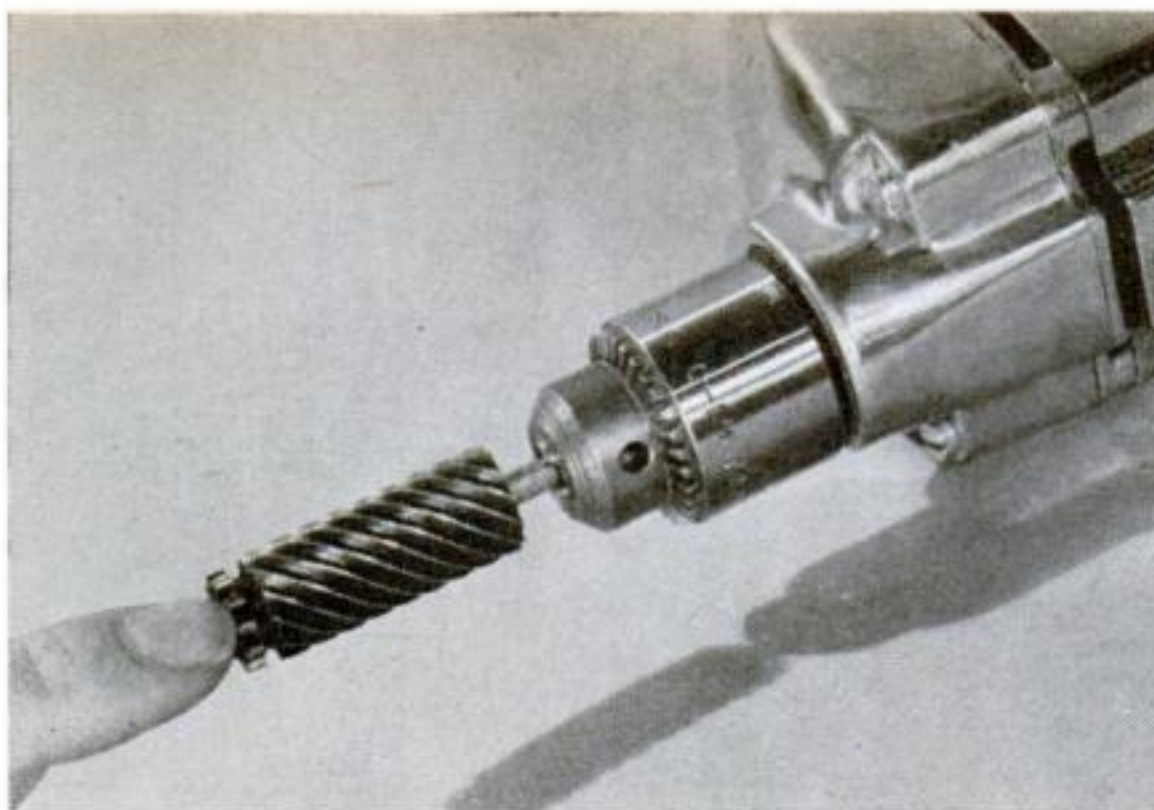


Shop Tips

FROM PS READERS

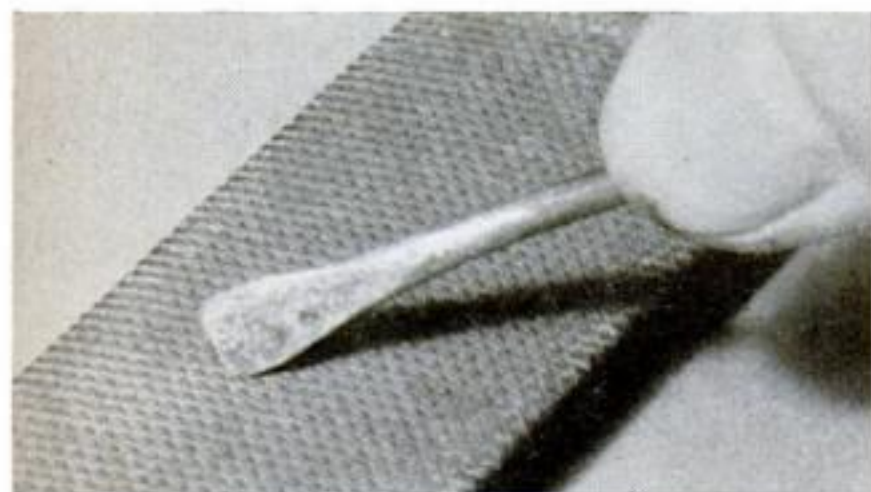
How to Improvise a Router Bit

THE cutter from a discarded pencil sharpener makes a handy router bit. Weld it to a shaft that fits the chuck of your portable drill or drill press (photo at right).—Ken Patterson, Moose Jaw, Sask.



V Block from Molding

NEED a V block in a hurry? Nail two strips of half- or quarter-round molding side by side on a piece of scrap. If you need a V block for welding, slice a large-diameter nonferrous rod down the middle and drill each half for screws.—Roger Isetts, Kenosha, Wis.

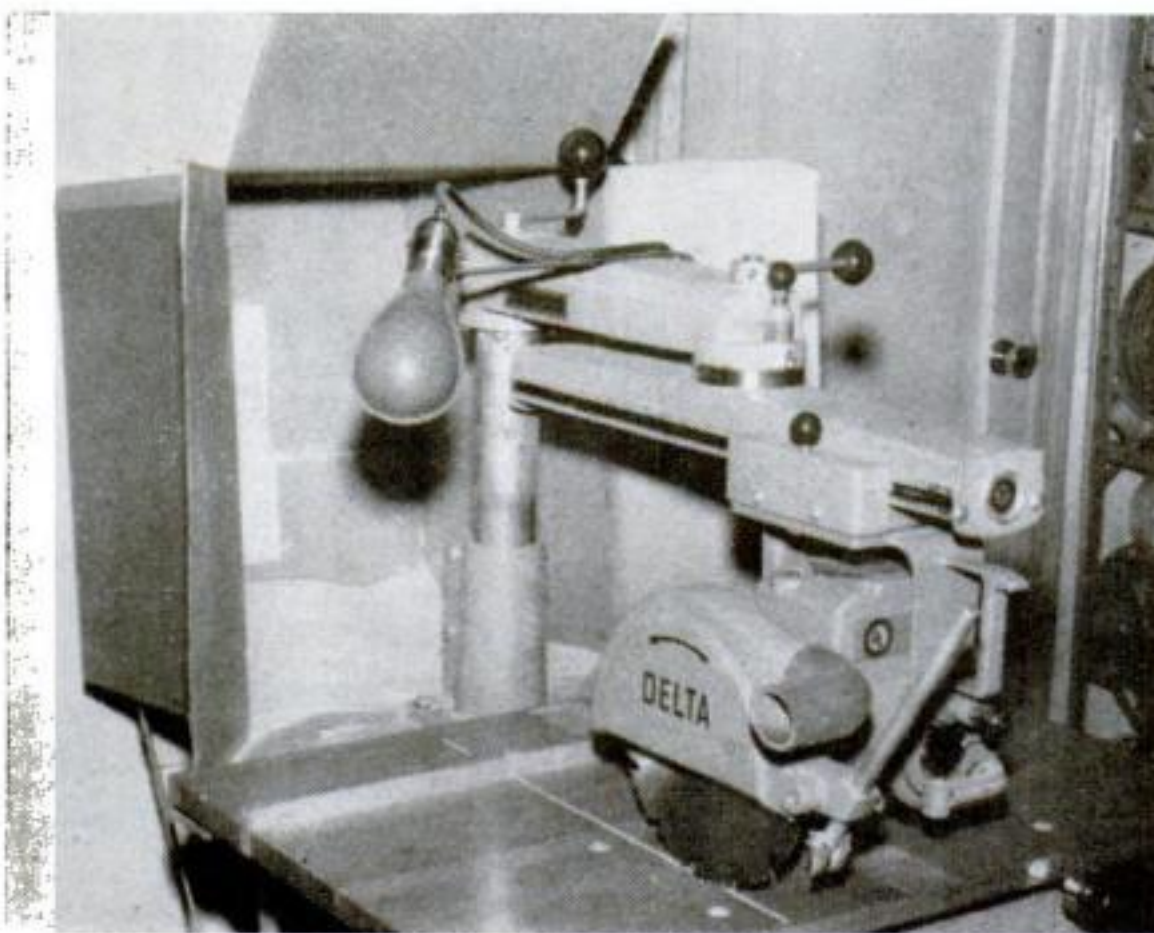


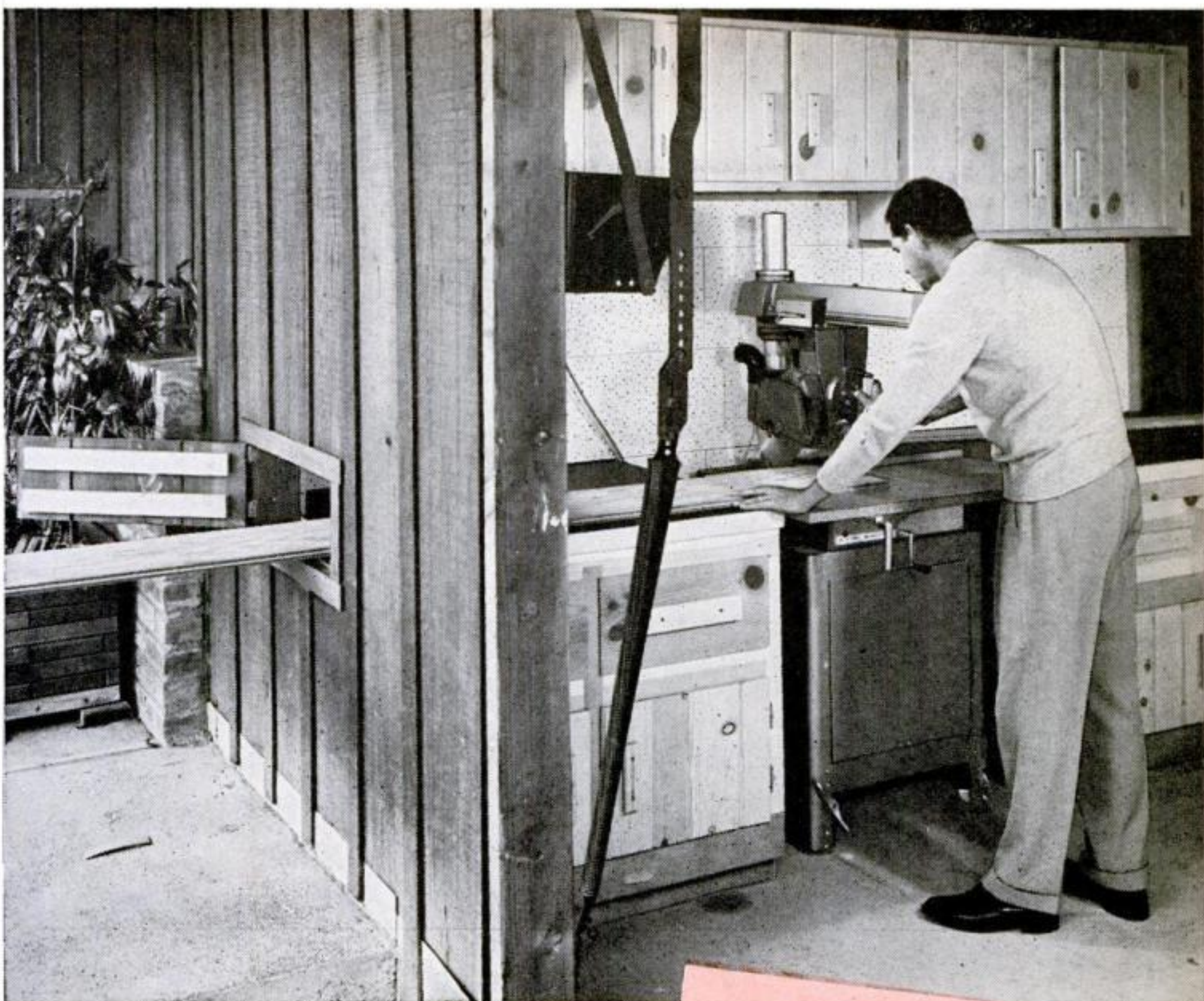
How to Clean Metal Files

Good files deserve respect. When you dig metal out of clogged teeth with a knife, awl, or scriber, you dull two tools. Instead, form a loop for a handle at one end of a piece of heavy copper wire and flatten the other end to a thin working edge. This removes metal that a file card misses—and does it without harming the teeth.—Bert Moon, Orient, N. Y.

Inexpensive Sawdust Catcher

RADIAL-ARM saws are notorious sawdust throwers. Save broom time by fastening a cardboard carton of appropriate size at the back of the saw. Bolt or tape one flap to the underside of the table, and support the upright bottom with threaded rods attached to the box (with nuts and washers) and to the saw stand. Angle the flaps for a funnel effect. Cutting a cleanout door in the box adds convenience.—John C. Kaiser, Flushing, N. Y.





Getting Full Value from a Radial-Arm Saw

By R. J. De Cristoforo

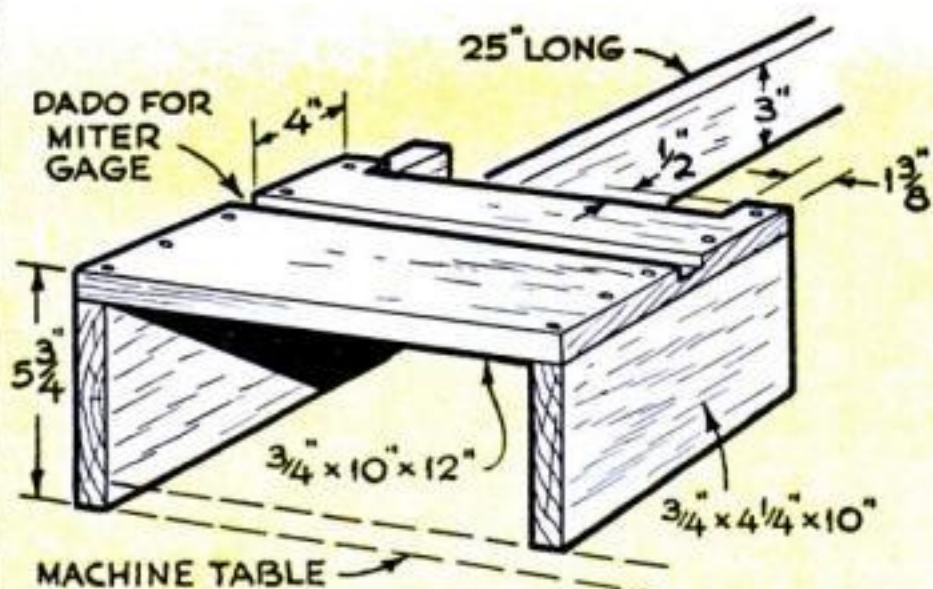
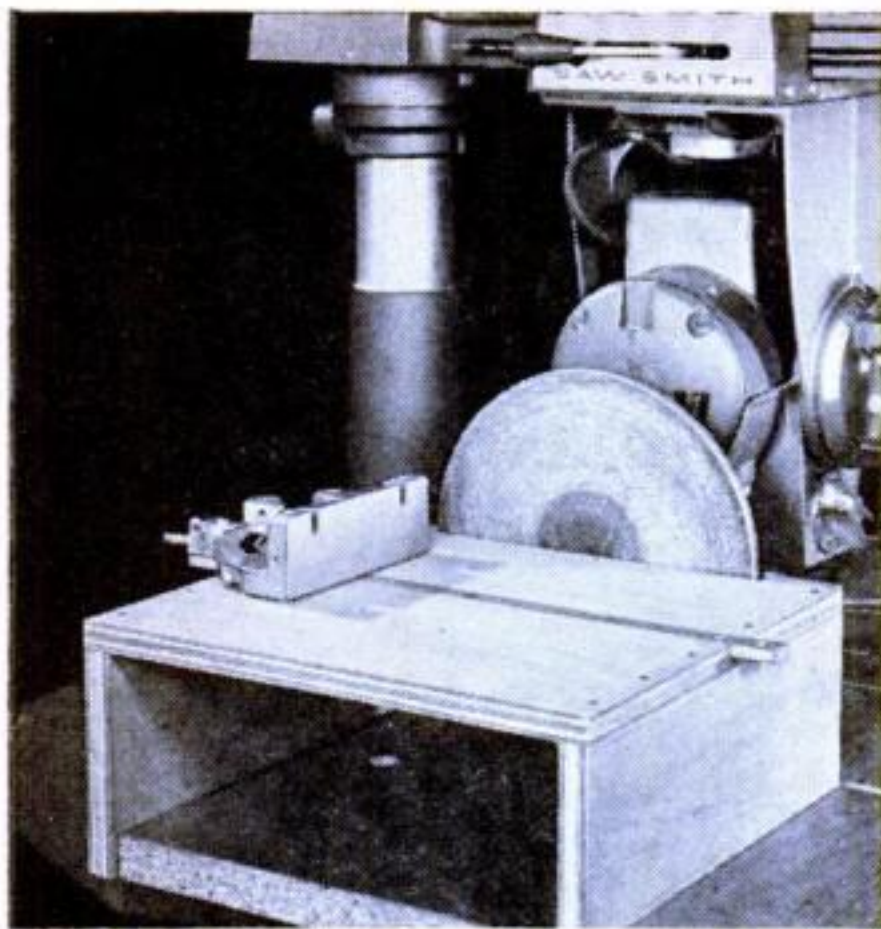
THE radial-arm saw is a rugged and flexible tool that's ready to give you your money's worth the moment it's out of its crate. But there's *extra value* that's yours for the taking if you know how to make the most of the machine's capabilities.

Simply choosing the right location for the saw can extend its usefulness. The photo above illustrates how a well-planned hole in the wall of a small shop lets you handle boards of unlimited length. If you join the siding with cleats and cut the opening carefully, the piece cut out of the wall can be hung on hinges to become a door. Lay out the opening

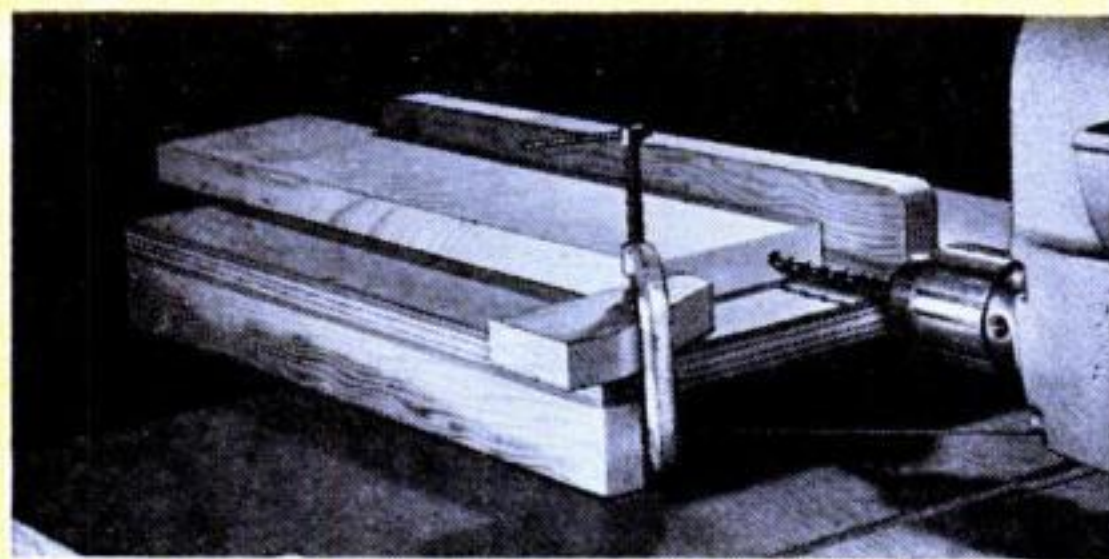
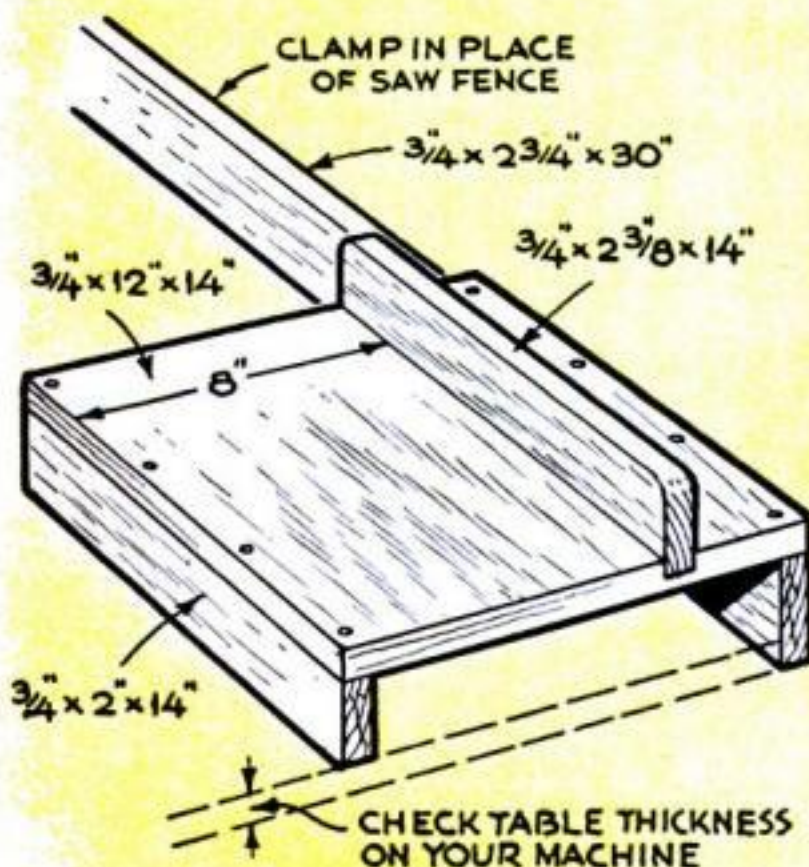
A PS Winter Workshop SPECIAL

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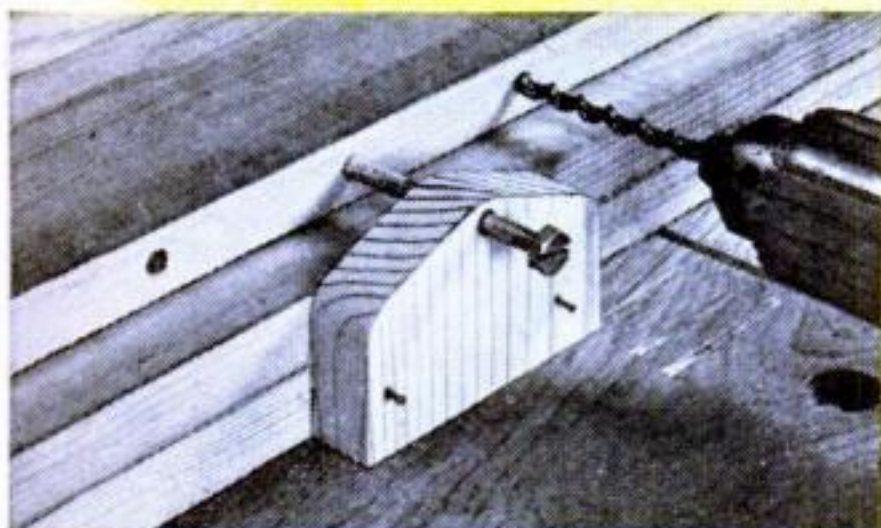
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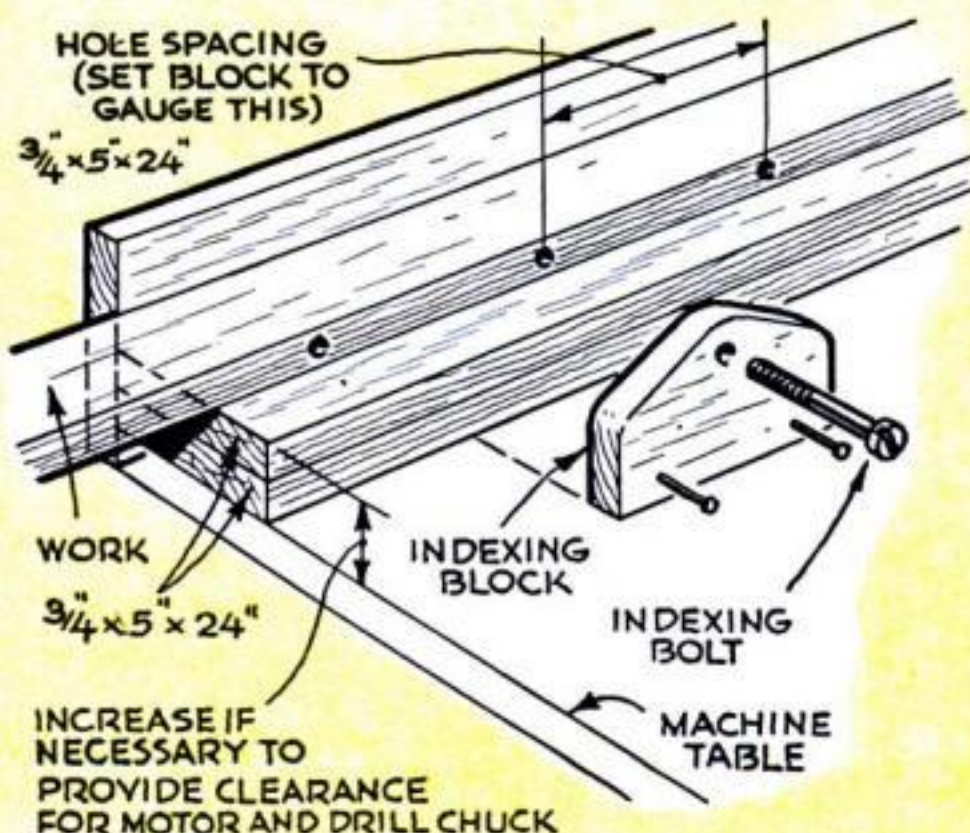
SANDING DISK, used with a boxlike auxiliary table, converts the saw into an efficient disk sander. You can tilt the disk to smooth bevels and chamfers, or lock it upright for straight edges. The long leg on one side of the table shown above is clamped in the groove usually occupied by the saw fence. Miter gauge can be bought, or you can make your own.

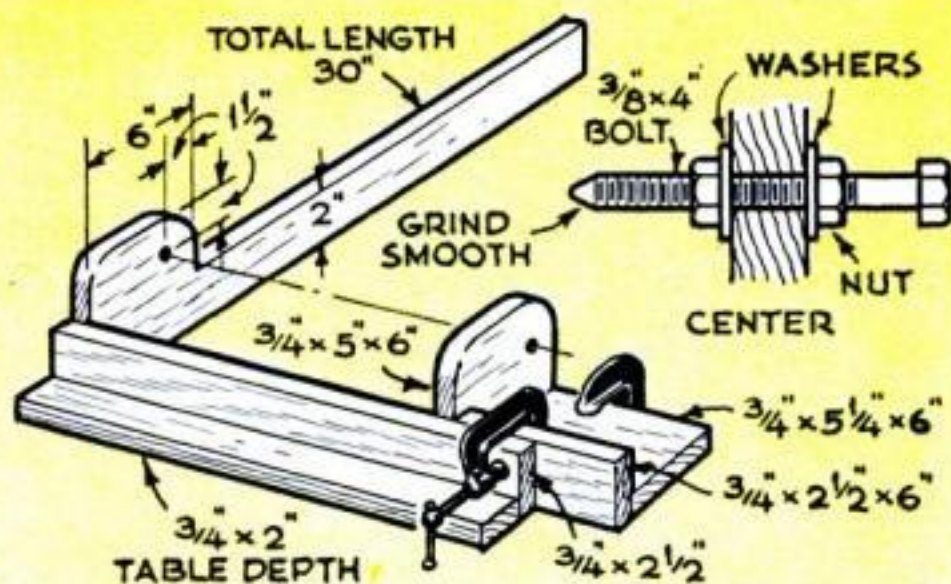


HOLES CAN BE DRILLED in ends of boards by sliding work into drill. Fence on auxiliary table guides board. A stop block clamped to the table limits the depth of the hole. Long leg of table is clamped in regular fence groove. Accessory drill chuck fits on the saw arbor.

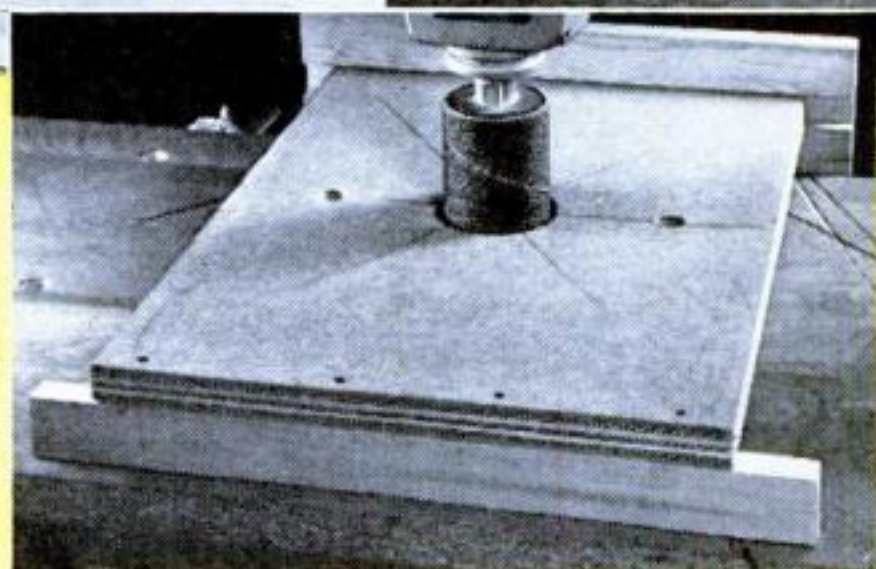
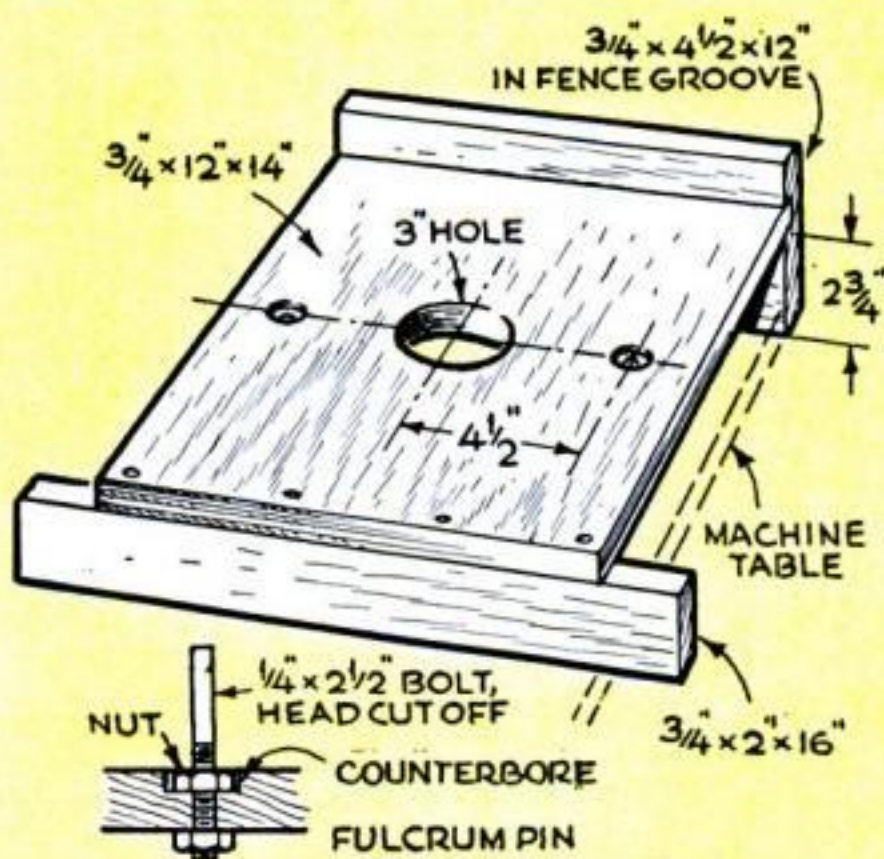
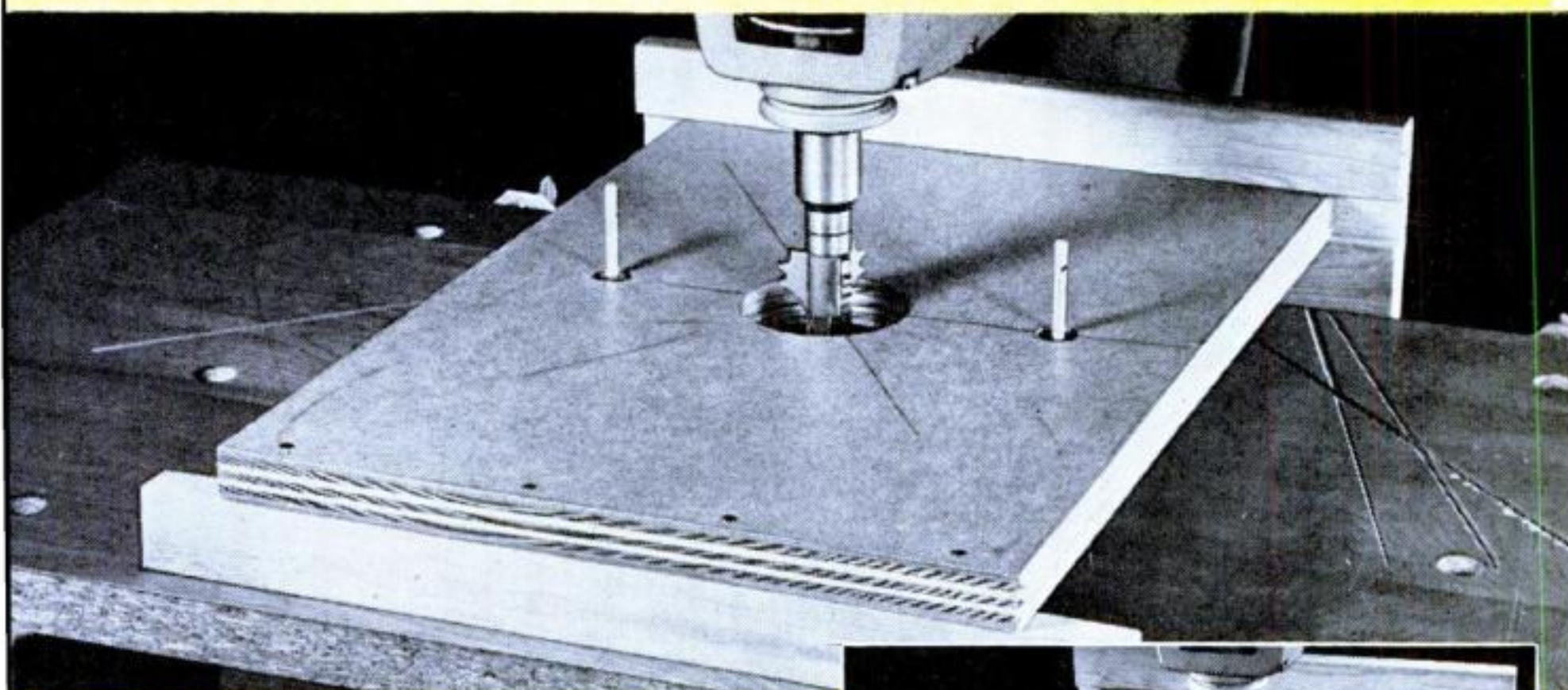
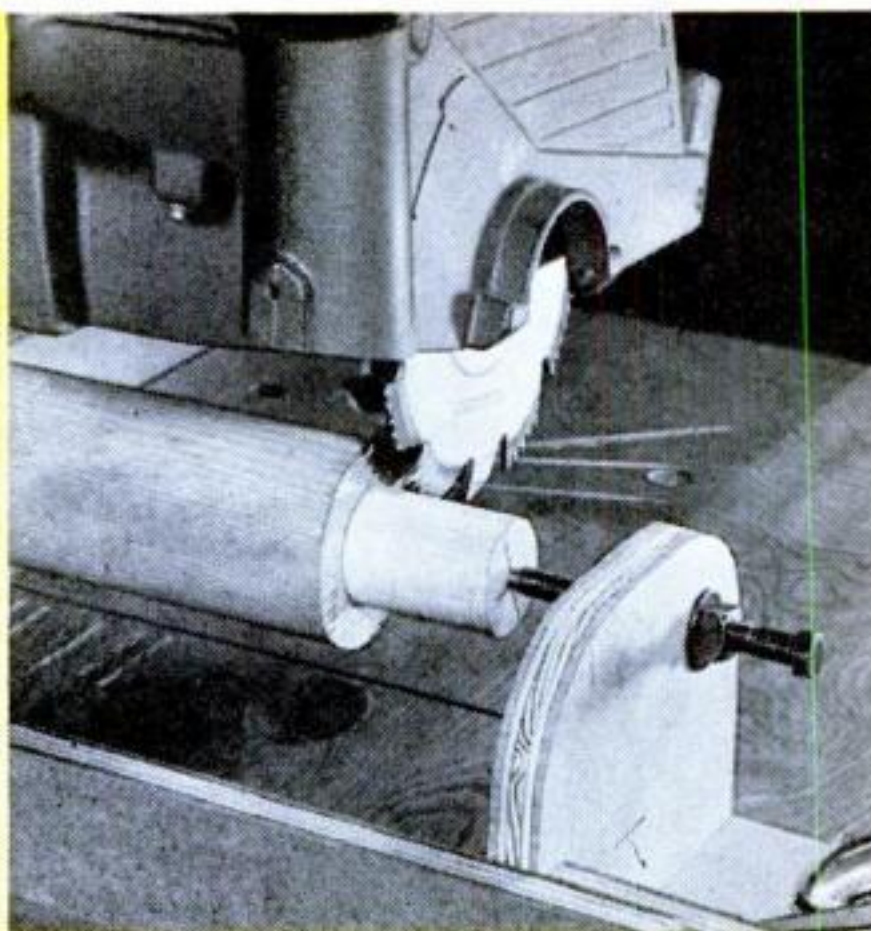


DOWEL HOLES for edge-joining lumber are drilled accurately with this setup. If boards are all placed top face down when drilled, the holes will line up precisely when they're brought together, minimizing planing required to produce a flat surface. Drill is fed into work. Clamp on machine arm limits depth of hole. Indexing pin spaces the holes equally.





WOOD TURNING can be done by mounting work between centers in a jig like this one. Grip the work and lower a dado cutter (never a molding head) into it with guard adjusted to cover the cutter on the operator's side. Rotate work into teeth of cutter, taking several passes for deep cuts. You can form tapers by offsetting one jig center; V cuts, by tilting cutter.



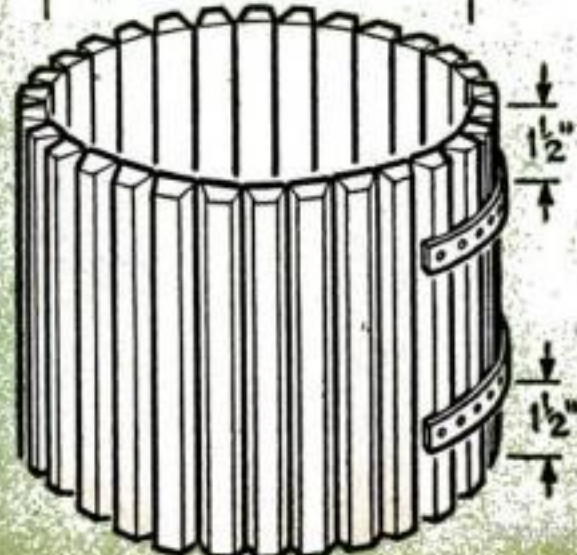
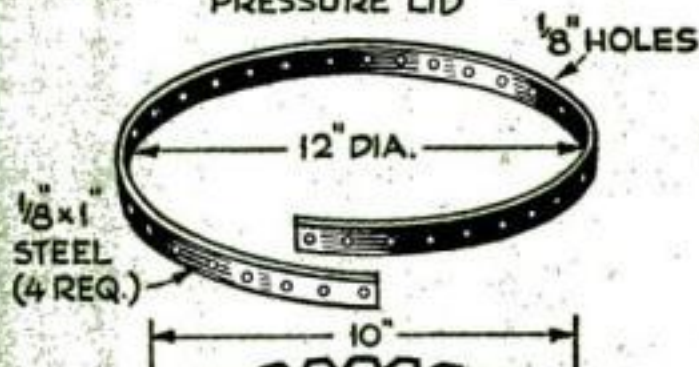
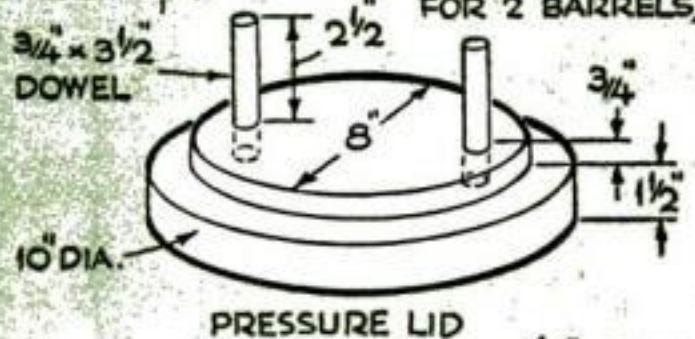
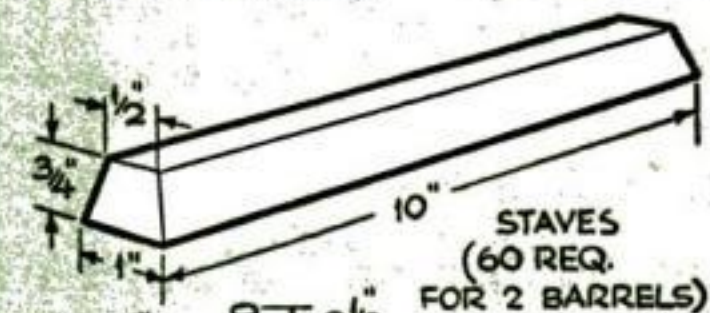
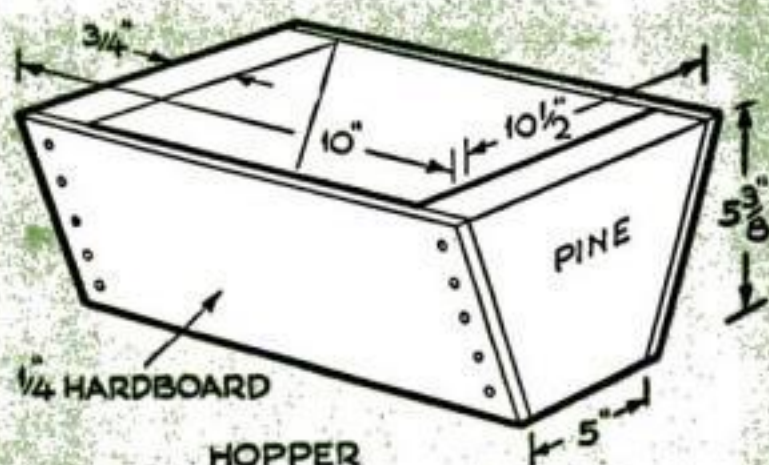
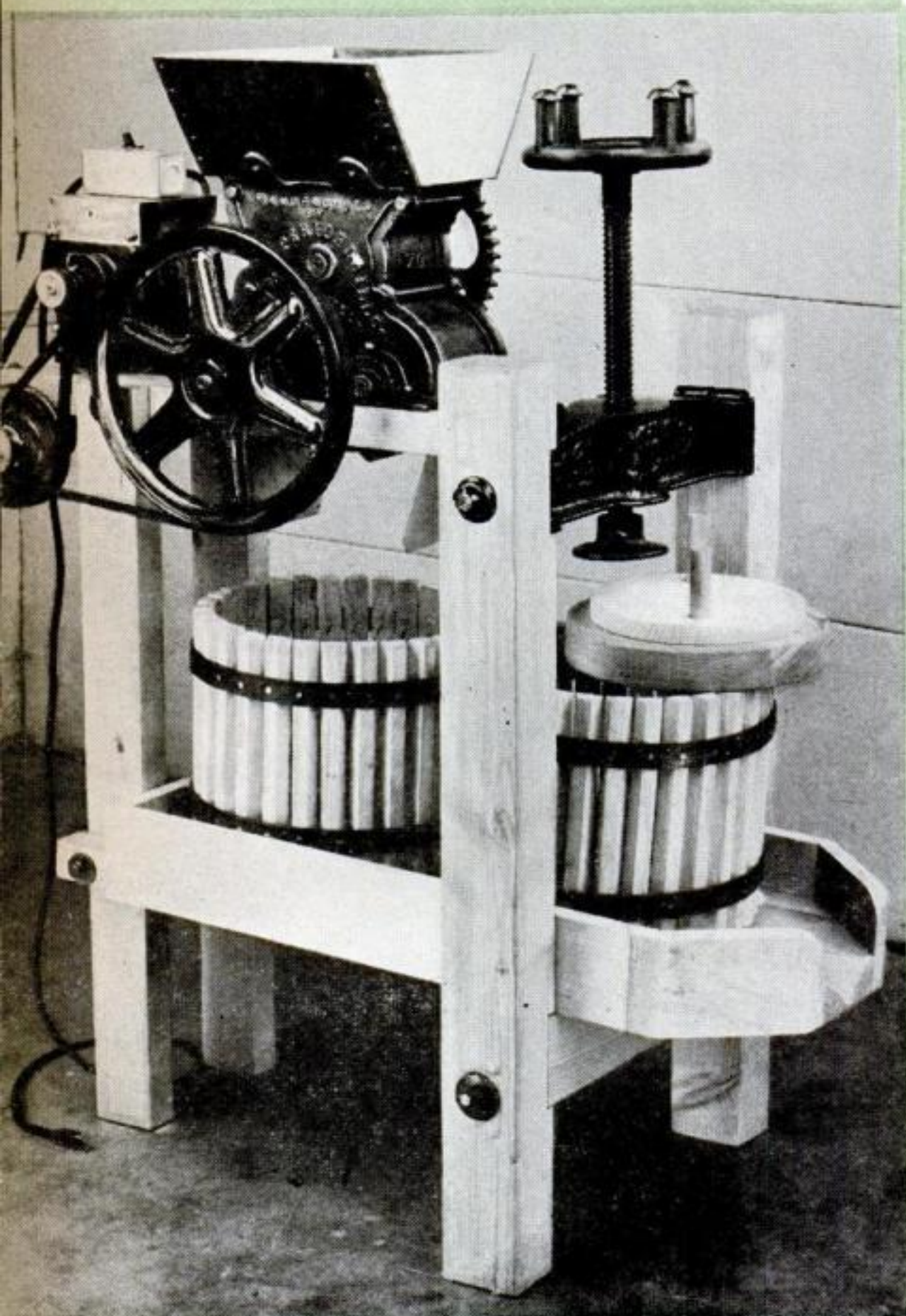
FREEHAND SHAPING against stop collars mounted on arbor above cutters is safe and easy with this jig. Fulcrum pins in hardboard-surfaced auxiliary table (upper photo) provide support at start and end of cut. Raising or lowering the machine arm adjusts depth of cut. Same table can be used for drum sanding. Make hole in center about 1/4" larger than drum.

How I Rebuilt a Cider Press

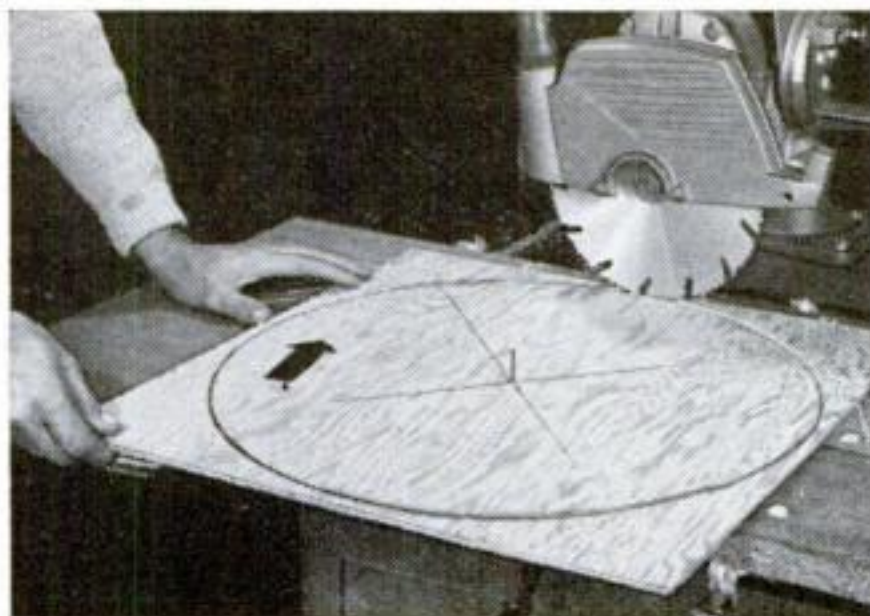
By Glenn E. Sprouse

I FOUND this beautiful old cider press lying in pieces in a junk yard. Restoring it to good-as-new condition was more fun than work, and cost less than \$10. This fall when the apples are ripe, using it will be priceless fun for my family and friends. Even when not in use, it's a wonderful conversation piece.

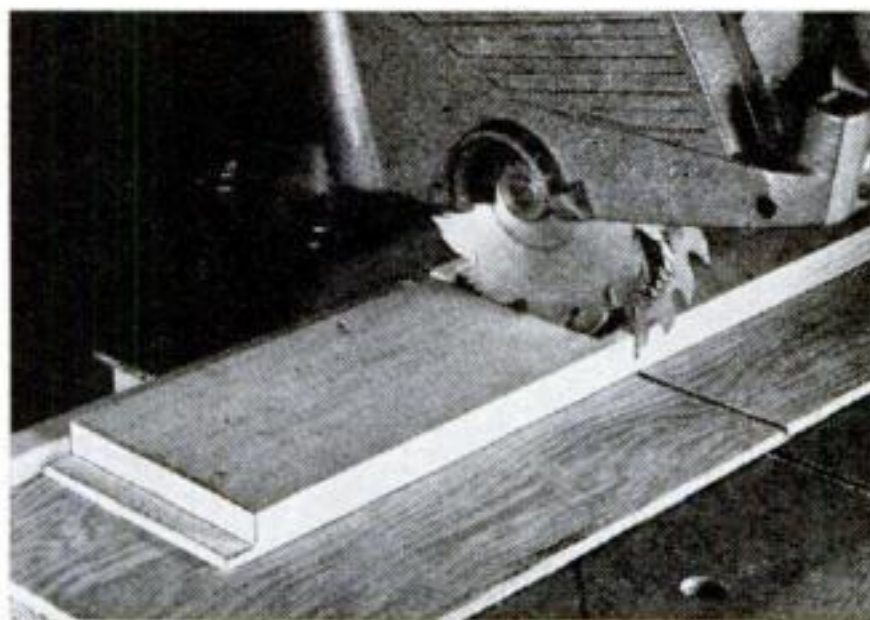
The machine looks as if it had been made to last forever. Metal parts, including the gears, are cast iron, with cast-in scrollwork



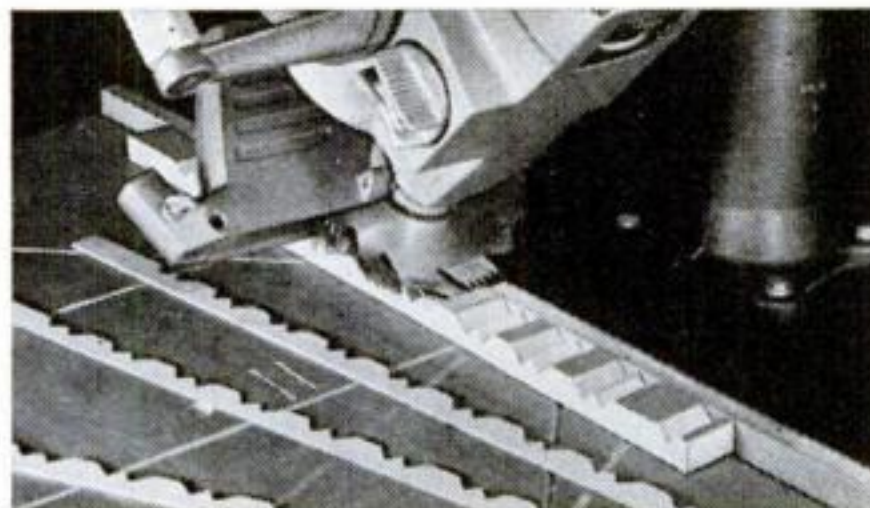
These trick cuts have everyday shop applications



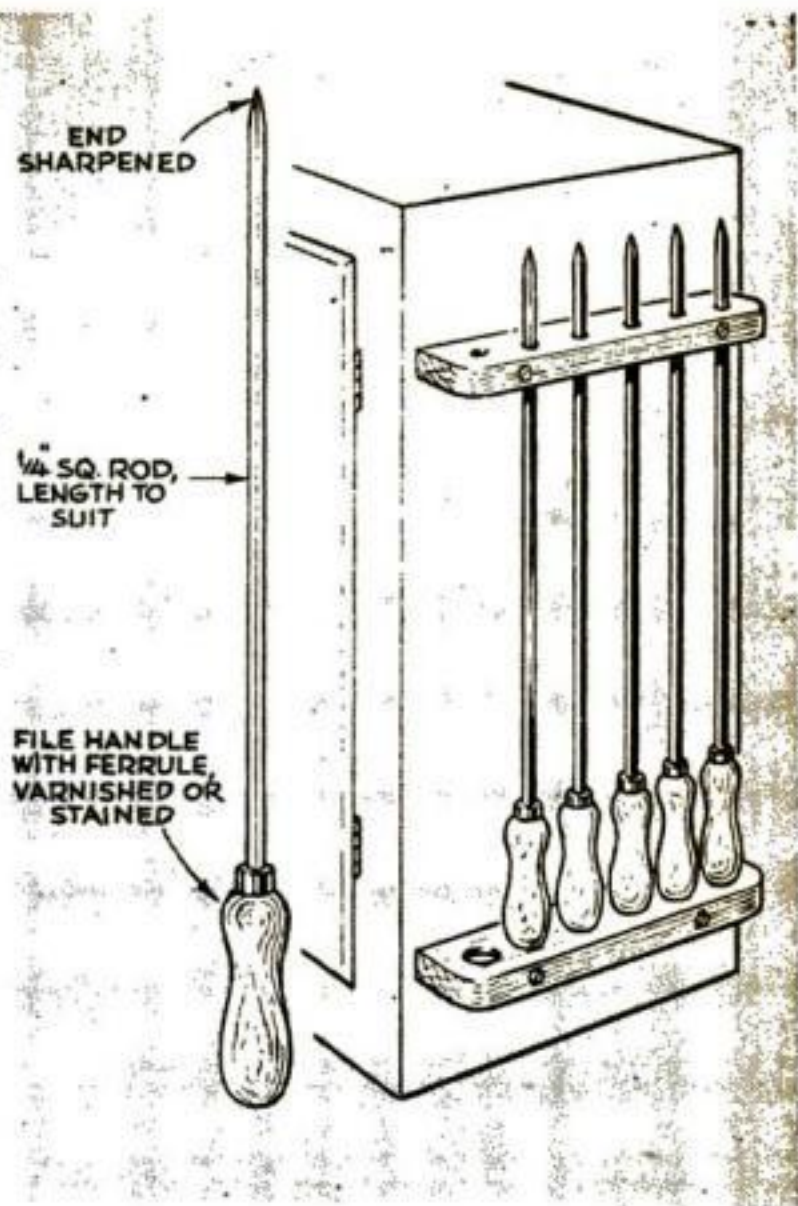
YOU CAN CUT CIRCLES out of panels by pivoting the work into the blade on a nail driven into the saw table. Take light cuts, lowering the blade $1/16$ " to $1/8$ " after each pass. For large circles, establish a pivot point on a well-anchored stand level with the saw table.



MAKE TWO CUTS IN A SINGLE PASS by combining a dado assembly with a saw blade. The blade cuts through, while the dado chews out a rabbet beside the cut—a fast way to make drawer fronts. Place a scrap board under the work to prevent deep cuts in the saw table.



GETTING FANCY FOR A GOOD REASON: Make surface cuts in a repetitive pattern across the grain of a clear board. Then rip the board into thin or heavy strips to produce decorative trim molding that you can use around your home or on cabinet projects. ■ ■



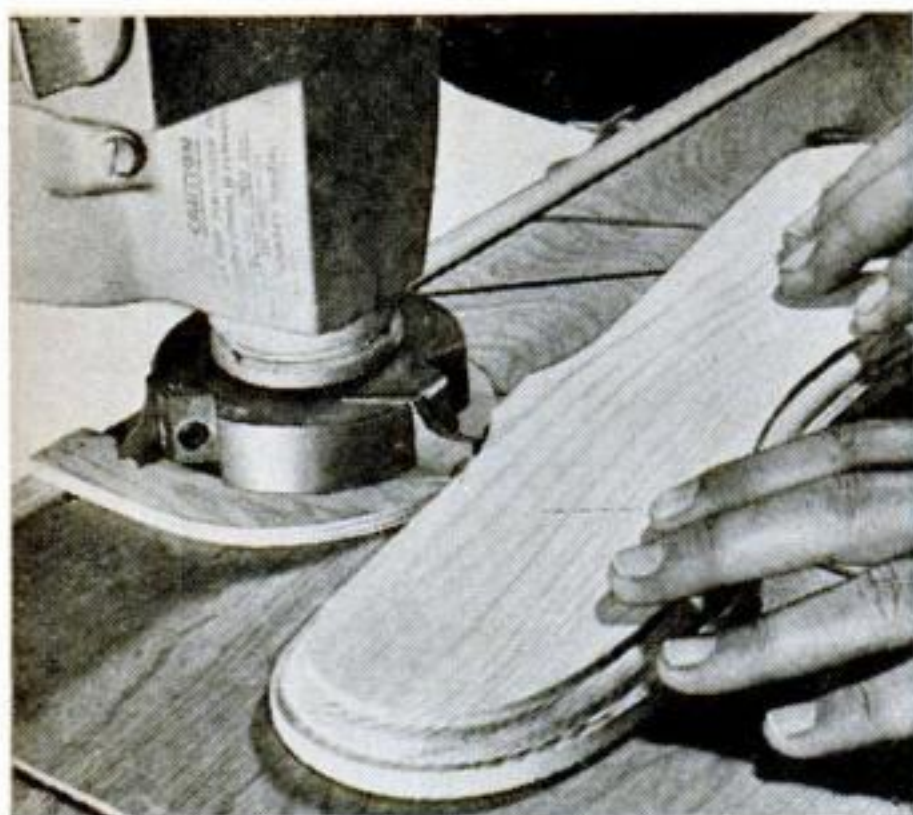
Shish Kebab Skewers

Using inexpensive file handles and lengths of $1/4$ "-square cold-rolled or stainless-steel rods, you can make a handsome set of barbecue skewers. The square rod keeps meat and vegetables from slipping as they are rotated over the fire. The simple rack illustrated can be mounted on the barbecue or, indoors, attached to the end of a kitchen cabinet.—*H. A. Fluchere, Irvington, N. Y.*

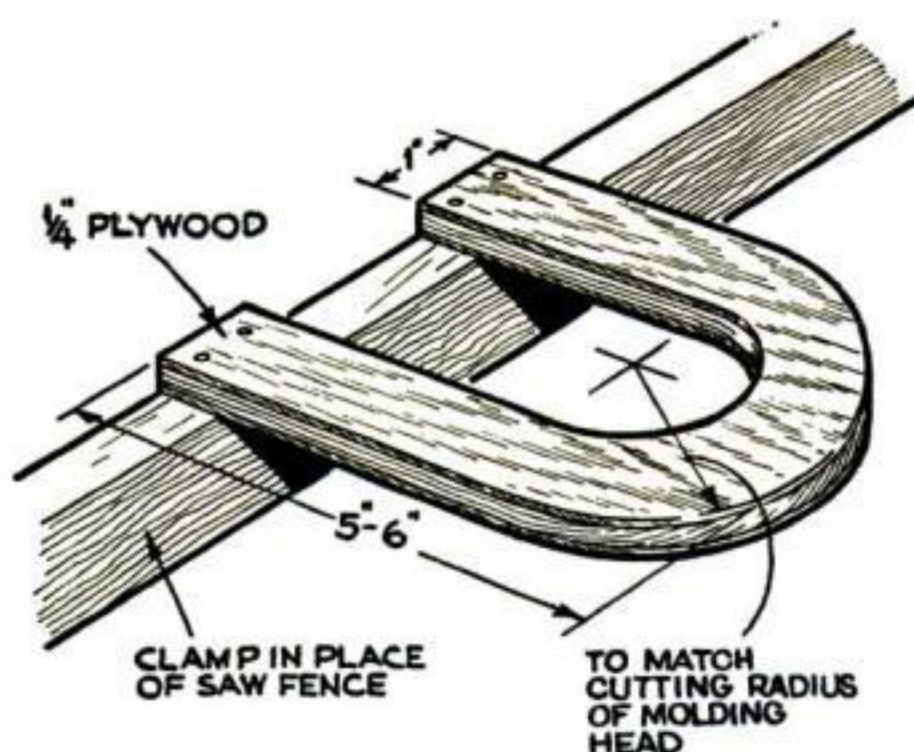


Milk Carton Lubes Saw

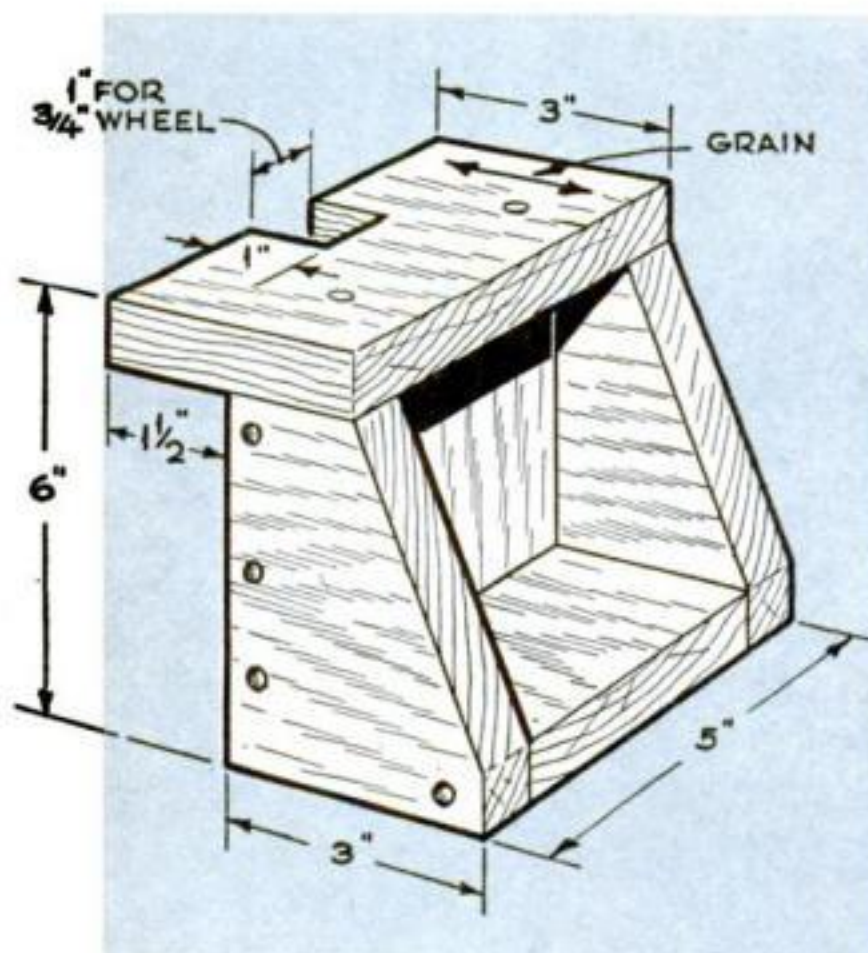
When the going gets rough hack-sawing metal, lubricate the blade by sawing into a paraffin-coated milk container. Paraffin will be deposited evenly on both sides of the saw blade.—*John A. Comstock, Winter Park, Fla.*



JIG FOR A MOLDING HEAD serves as a stop for shaping straight or irregular edges. Horizontal cutting depth is controlled by moving the carriage to vary the projection of the



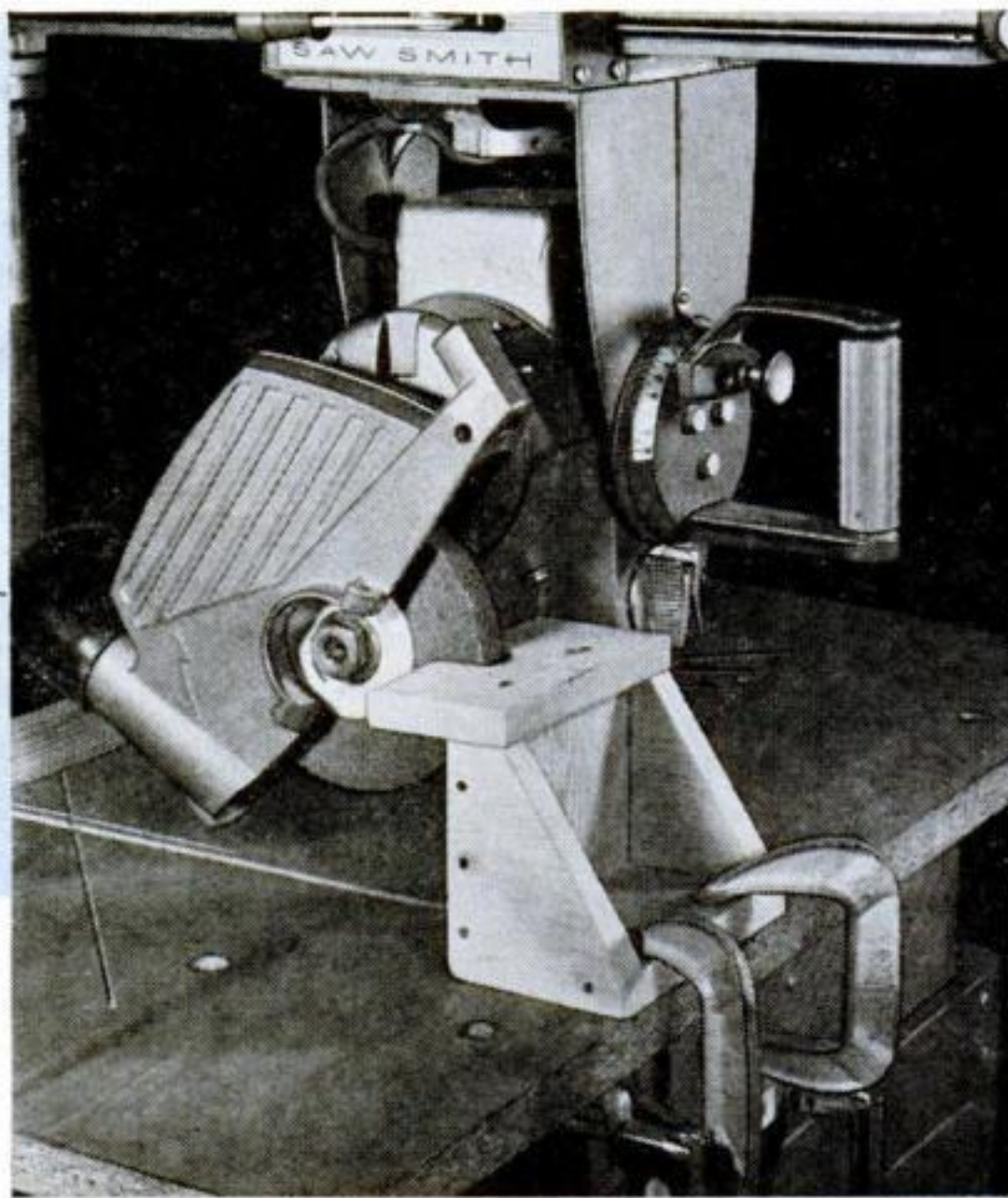
cutters beyond the guide. Adjust the vertical depth by raising or lowering the machine arm. Horseshoe shape is necessary to provide clearance for the lock nut on the end of the arbor.



USED AS A GRINDER for sharpening all your edged tools, the radial-arm saw already has everything needed but the tool support. Fit a suitable grinding wheel to the saw arbor and clamp this simple platform to the machine table. Raising or lowering the wheel will change the grinding angle. Adjust the guard for maximum protection—and wear goggles.

about $\frac{1}{2}$ " lower than the surface of the saw table and frame it with two-by-fours. Short, flush benches on each side of the saw provide ample support for smaller cutting jobs.

The flexibility of the machine, combined with a few easy-to-make jigs, permits you to do jobs you never dreamed



could be handled by a saw. These are more than just trick cuts—the radial-arm saw is already noted for its versatility in scooping out circular recesses or carving rosettes and diamond patterns in wood. The setups here and on the previous two pages are for practical everyday jobs that woodworkers will find useful.

Reach for This Booklet...



November 1961
POPULAR SCIENCE

... Next time you need the answer to a tricky question. Better still, read the booklet now and chances are, when the question does arise, the answer will come to the tip of your tongue, computer-quick.

To remove the booklet from the magazine, place your left hand on the facing page, grasp the booklet with your right, and gently pull it away.

The booklet doesn't promise magic. All the answers aren't here. But important and useful memory keys to a lot of answers are. For instance, it'll pay you to know the name (below) of ...



The Keeper of the Spectrum's Secret

Roy G. Biv, the sunny-faced fellow shown here, has just one job—to help you keep order among the colors of the spectrum. His moniker works out this way:

R = RED

B = BLUE

O = ORANGE **G** = GREEN **I** = INDIGO

Y = YELLOW

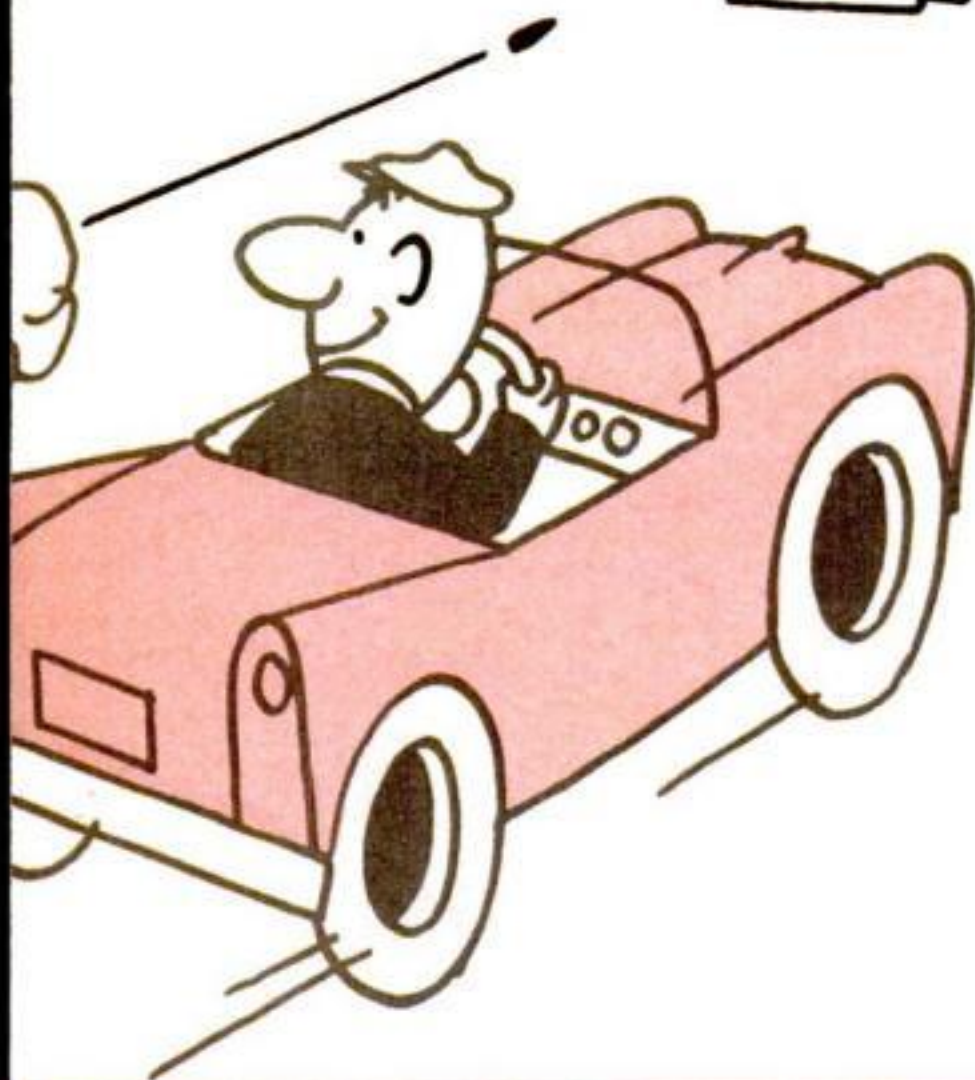
V = VIOLET

So let's all make note of the fine old name of Roy G. Biv.



The Power of 2

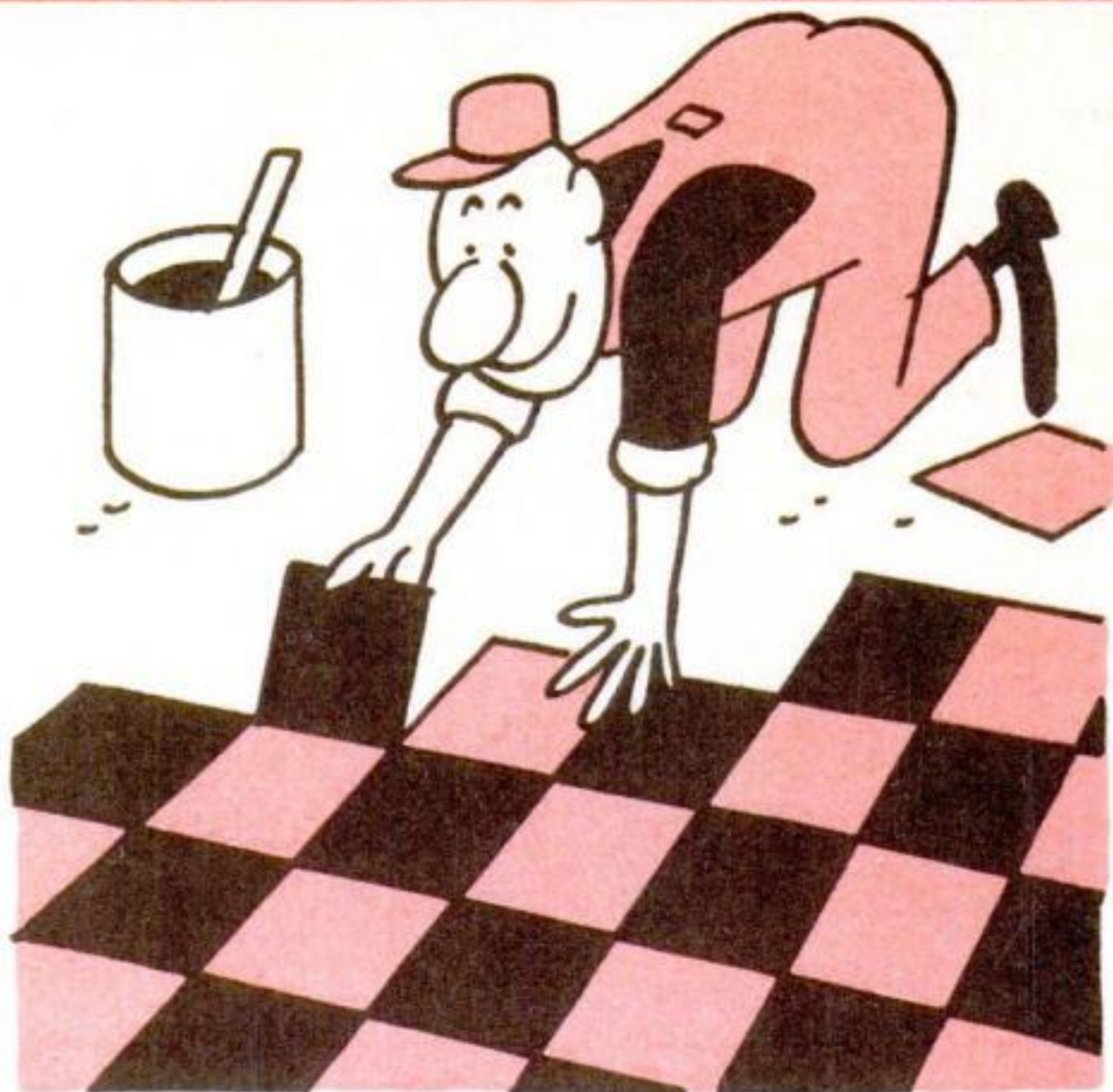
The number **2** is the secret for quick answers to questions like "If my car is traveling 60 m.p.h., how fast in feet per second am I moving?" Divide miles per hour by 2, and you have yards per second. Convert yards to feet. Example: $60 \text{ m.p.h.} \div 2 = 30 \text{ yards/sec.}$, or 90 f.p.s. When the question goes like this: "My rifle has a muzzle velocity of 2,400 f.p.s. How many m.p.h. is the bullet going?" Convert feet to yards, multiply by 2. Example: $2,400 \text{ f.p.s.} = 800 \text{ yards/sec.}$ $800 \times 2 = 1,600 \text{ m.p.h.}$ Your answer will be about 98 percent accurate.

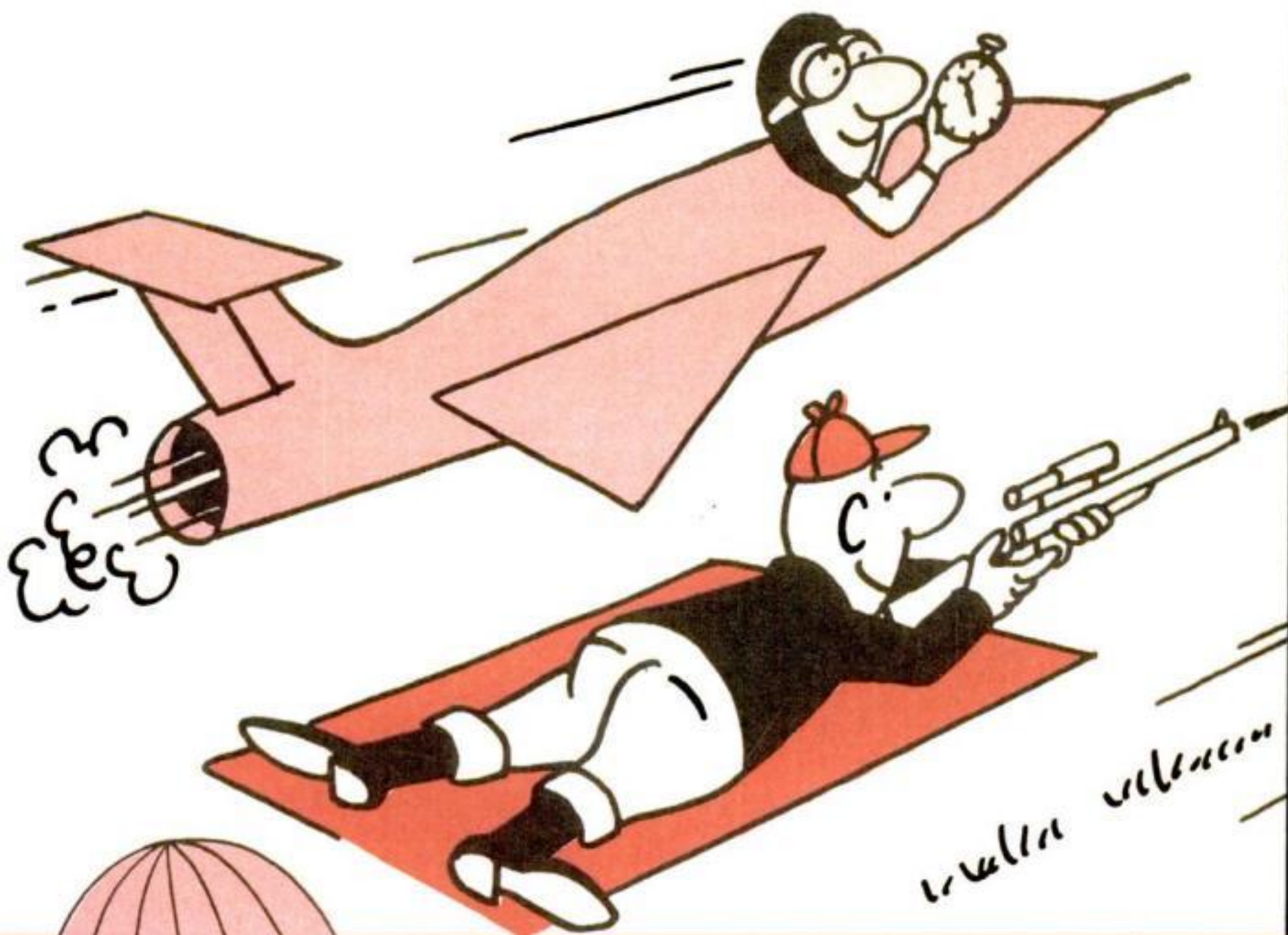


Floor-tile count.

How many standard 9-by-9 floor tiles do you need to cover a given space? Estimate the requirement this way: Multiply the floor length by the width, and multiply the product by 1.8.

The answer includes roughly 5-percent waste allowance, depending on the size of the floor. For example, a floor 18 by 12 feet: $18 \times 12 = 216$. Then $216 \times 1.8 = 389$ tiles.



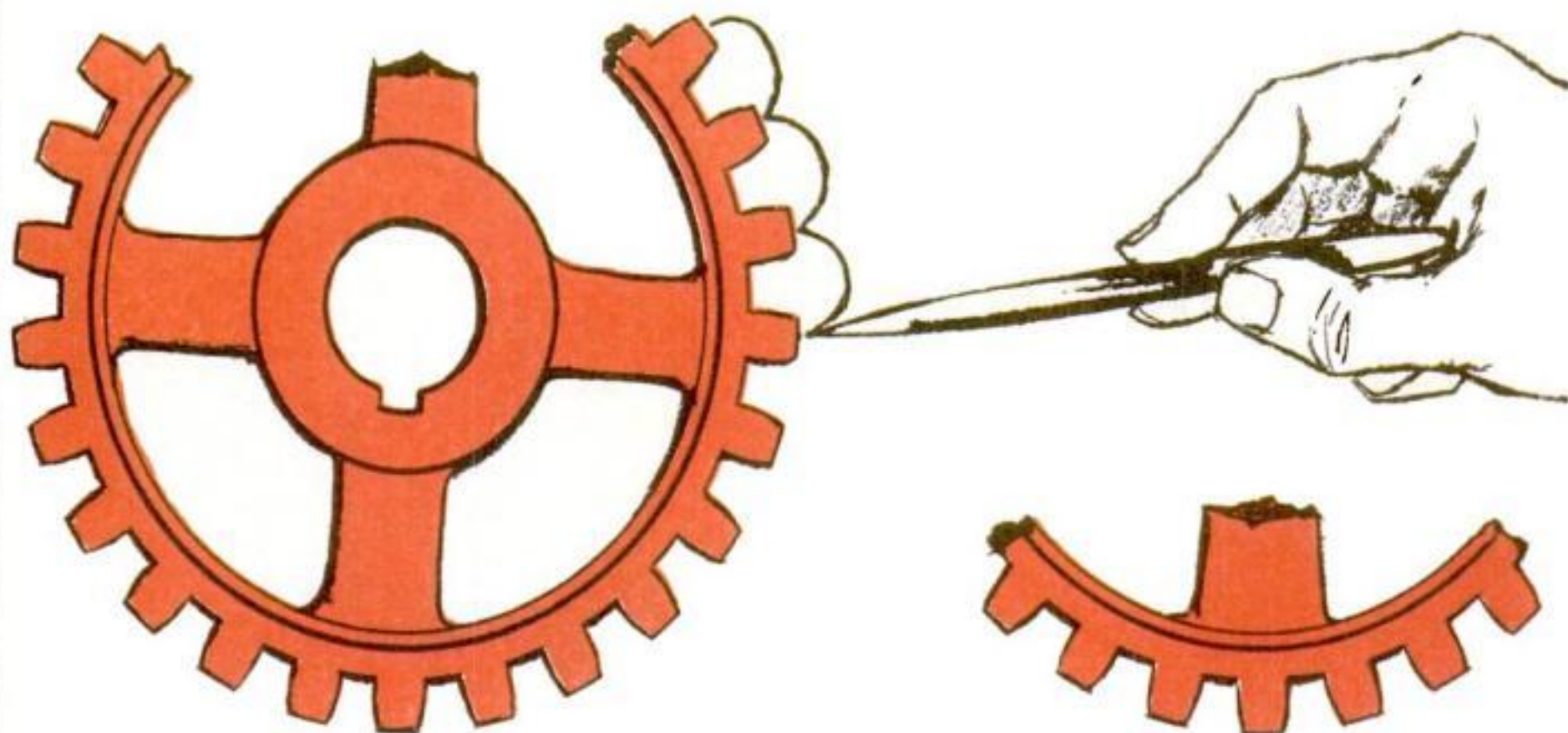


Air drop. As a rule of thumb you can count on air temperature dropping 2 deg. F. for every 1,000-ft. altitude increase—or vice versa.

The cash balance in your pocket. The coins in your pocket are a source of accurate comparative weights. Coins from a dime to a silver dollar have a 4-to-1 relationship between denomination and weight in grains. A dime weighs 40 grains ($4 \times 10¢ = 40$ grains); a quarter: 100 grains ($4 \times 25¢ = 100$ grains); a half dollar: 200 grains ($4 \times 50¢ = 200$); a silver dollar: 400 grains ($4 \times 100¢ = 400$ grains). An ounce is 437.5 grains.

When it pays to be a clock watcher. Think of the ideal working hours of 9 to 5 for conversions of centigrade to Fahrenheit temperatures and vice versa. Multiply centigrade temperature by 9, divide by 5, and add 32° , to convert. Example: $100^\circ \text{ C} \times 9 = 900 \div 5 = 180 + 32^\circ = 212^\circ \text{ F}$.

To convert F to C, subtract 32° , multiply by 5, divide by 9. For example: $80^\circ \text{ Fahrenheit} - 32^\circ = 48 \times 5 = 240 \div 9 = 26\frac{2}{3}^\circ \text{ C}$.



Determine exact pitch diameter of any standard spur gear without so much as touching the gear in question. Simply count the teeth and divide by the diametral pitch. (For data on DP, see

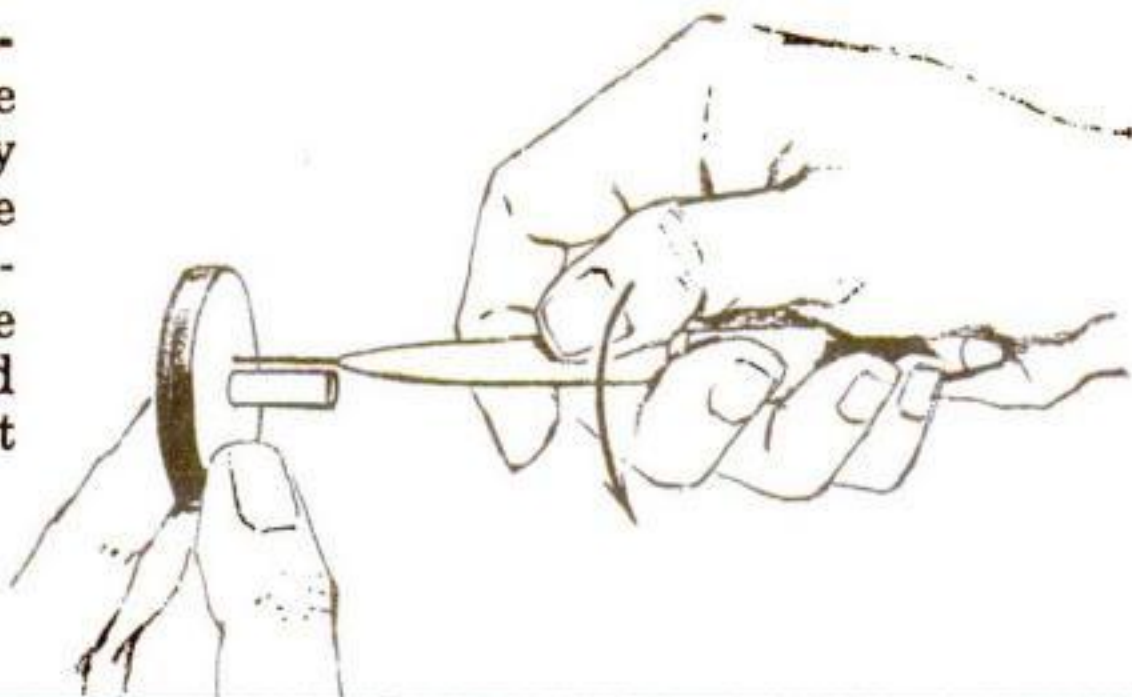
the facing page.) For example: 20 teeth divided by 4 DP = 5.000" pitch diameter. (This method cannot account for backlash that may have been designed into the gear.)

V-belt pulleys. Approximate effective pitch diameters can be determined without calculations by simply subtracting the thickness of the pulley belt plus $1/16"$ from the outside diameter of the pulley. For example: a size "B" V belt is about $7/16"$ thick, so $7/16" + 1/16" = 1/2"$. Subtracting $1/2"$ from o.d. measurement of a "B"-size pulley will give you the pitch diameter.

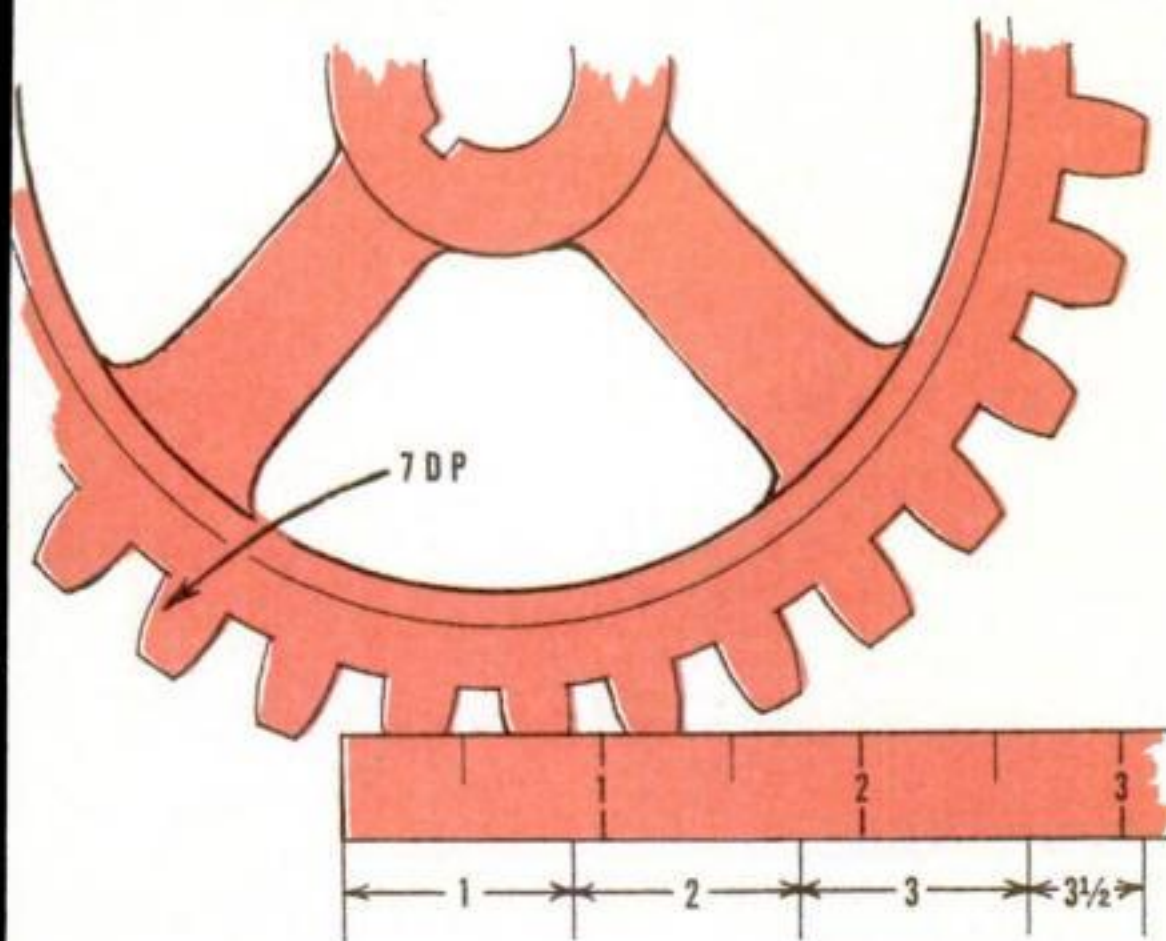
Short-length measurements can be made with the mechanical pencil you carry in your pocket. Determine the amount the lead advances for each turn of the barrel. Start with the lead flush with the pencil collet and count the turns.

The secret 13 of screws and bolts. Thirteen is the secret of the mystifying system of seemingly nonsensical wood-screw shank diameters and number-sized bolt diameters.

Simply multiply the number of the screw or bolt by $.013"$ and add $.060"$. That is the diameter. For example: a #10 wood screw or bolt is $10 \times .013"$, and $.130" + .060" = .190"$.



More Easy Ways to Become a



Find spur-gear DP (diametral pitch) by measuring the number of times two pitches will fit in 3" on a scale, and halve to produce the pitch. Measure halfway between the teeth at about the middle of the tooth depth. Disregard small departures to arrive at an even answer. (Standard pitches in the size normally encountered are whole numbers from about 4 diametral pitch through 40 DP.

Bolt thread length is normally about twice the diameter of the bolt, plus $\frac{1}{4}$ ". For example, a $2\frac{1}{2}$ "-long bolt of $\frac{1}{2}$ " diameter: $\frac{1}{2}" \times 2 = 1"$. $1" + \frac{1}{4}" = 1\frac{1}{4}"$, the usual length of thread.

Medium-flat washer diameters should be figured to be about twice the bolt size, plus $\frac{1}{4}$ ". For example: a $\frac{1}{2}$ " medium-flat washer will be $\frac{1}{2}" \times 2 + \frac{1}{4}"$, or $1\frac{1}{4}"$ outside diameter.

The code on a grinding wheel may sound like gobbledygook to you. But there is a method to the seeming madness. A few parts of the code are relatively unimportant to most users, but many of them are important. Here's how to sort out the symbols, using a typical code as a sample:

44A60-H8VG

The letter to the left of the hyphen denotes the kind of abrasive. "A" means aluminum oxide, "C" means silicon.

44A60-H8VG

The letter to the right of the hyphen reveals the grade—or relative hardness

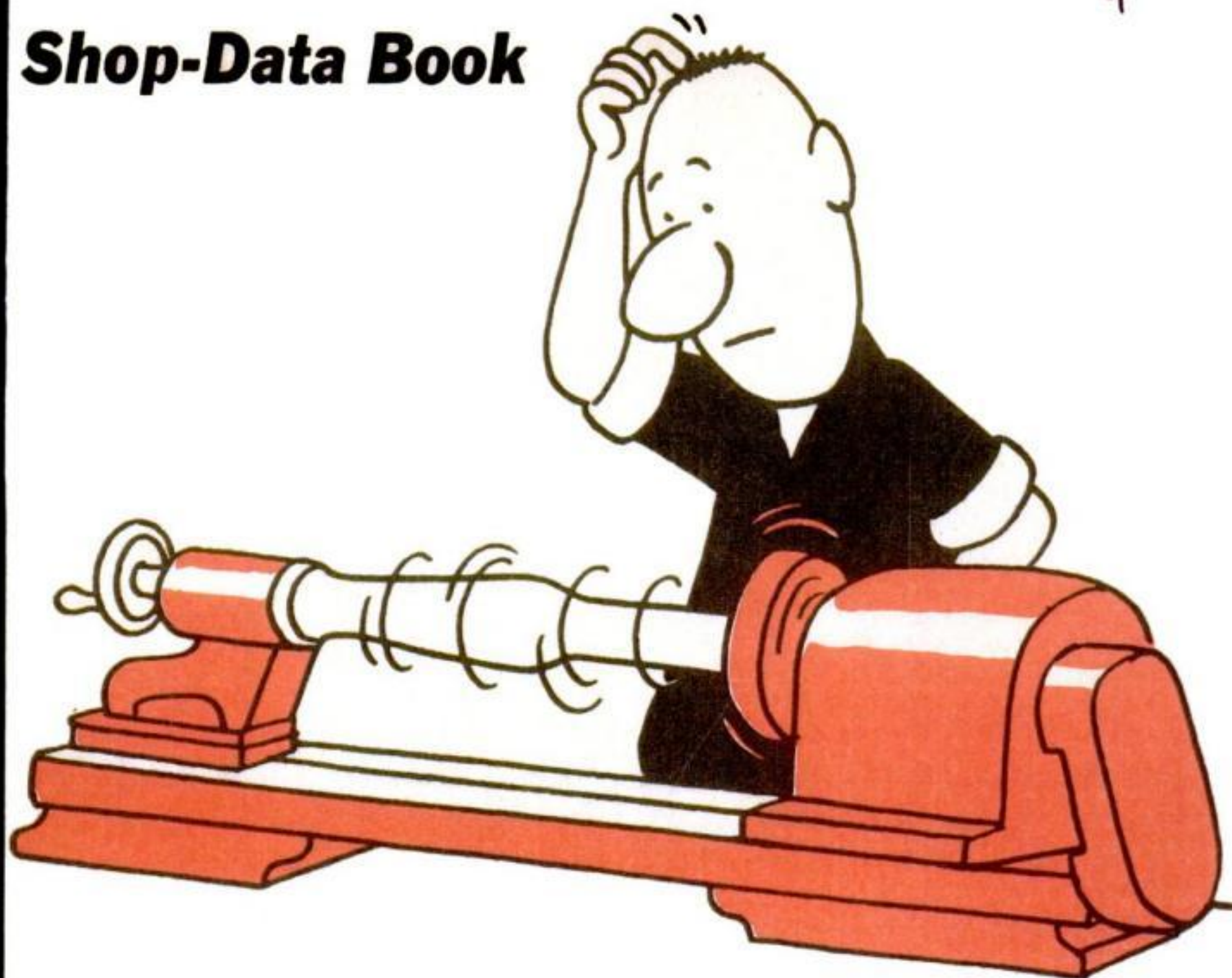
of the wheel. A is the softest, Z the hardest. So letters before the mid-alphabet letters L and M tend to be softer, those after the mid-point harder.

44A60-H8VG

The number next to the hyphen tells the grit size. Numbers from 10-24 are coarse; 30-60, medium; 70-180, fine; 220-600, very fine.

44A60-H8VG

The mid-sequence letter stands for the type of bond. The usually encountered wheels will display either a "V" for vitrified (fired), or a "B" to indicate that the wheel is resin bonded.



Determine surface speed in feet per minute (s.f.m.) for a given spindle speed and work (or tool) diameter by multiplying $\frac{1}{4}$ of the speed by the work or tool diameter. For example: a lathe running 400 r.p.m., 3" work diameter, what s.f.m.? Here's how: $\frac{1}{4}$ of 400 r.p.m. = 100. $100 \times 3" = 300$ s.f.m.

When you want to select a speed to

give a desired surface speed, divide desired s.f.m. by work or tool diameter; multiply by 4. Example: You want 300 s.f.m. for 3" work diameter. Find machine speed required this way: $300 \div 3" = 100$. $100 \times 4 = 400$ r.p.m.

These mental calculations, you'll find, are accurate to something like 4 percent.

Tensile strength of steel is easy. A rule of thumb for making an approximate calculation goes like this:

Halve the Brinell hardness number of the material under consideration and multiply by 1,000. For example: You have a steel with a hardness of 186 BHN. So, $186 \div 2 = 93$, and $93 \times 1,000 = 93,000$ p.s.i., the approximate tensile strength.

What about equivalent hardness? In the most commonly used portions of the scales, Brinell hardness numbers equal approximately 1/10th of the equivalent hardness indicated on the Rockwell "C" Hardness Scale. Multiply Rockwell C numbers by 10 to get the approximate Brinell equivalent. For example: $50 \text{ Rc} \times 10 = \text{about } 500 \text{ Br}$. $350 \text{ Br} \div 10 = \text{about } 35 \text{ Rc}$.

Easy Ways to Become a Walking

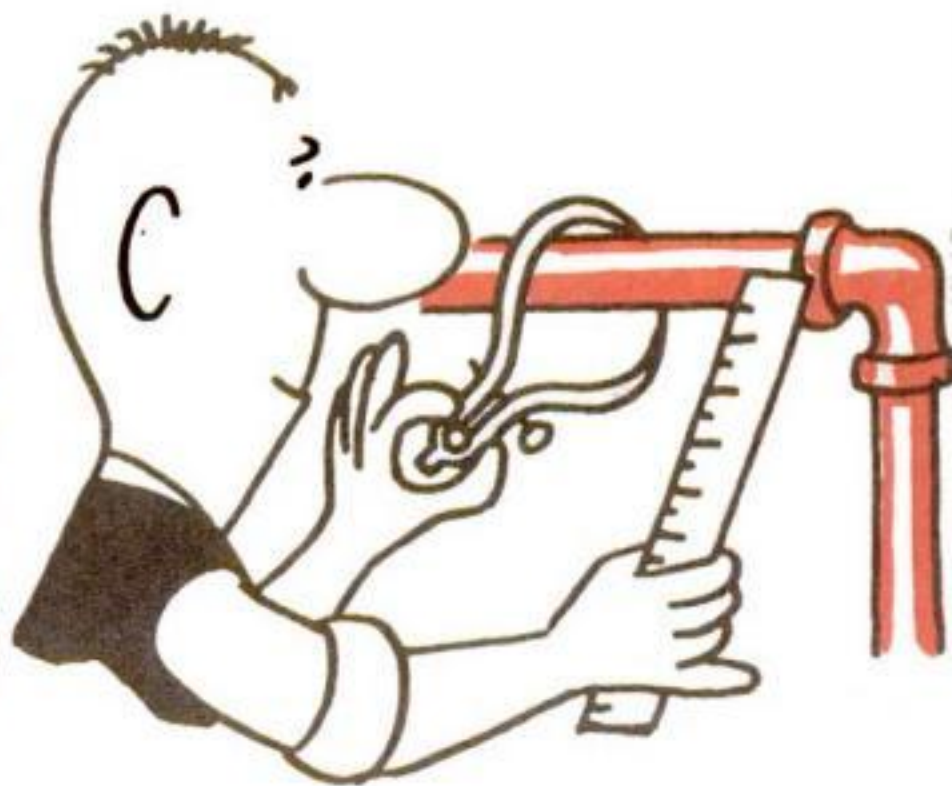


Determine tap-drill size by dividing the number of threads per inch into 1. Subtract from the nominal thread size. The answer is drill size for the recommended 75-percent full thread depth for any American Standard thread. Example, $\frac{1}{2}$ "-20 NF thread: $1 \div 20 = .050$ ". So, $.500$ " ($\frac{1}{2}$ ") - $.050$ " = $.450$ ". Select closest-size drill; in this case, it would be $\frac{29}{64}$ " ($.453$ ").

Decimal equivalents bothersome for you? Convert fractional dimensions to thousandths of an inch by remembering the decimal value of a 64th of an inch— $.0156$. Convert your fraction to 64ths of an inch and multiply by $.0156$. For example: $\frac{5}{32}$ " = $10/64$ ths. So $10 \times .0156 = .156$ ".

Correct wrench size for nuts and bolts doesn't have to be found by trial and error. To pick up just the tool you need, you merely have to remember that the right wrench is almost always $1\frac{1}{2}$ times the nominal thread size of the bolt or nut. For example: a $\frac{1}{2}$ " bolt takes a $\frac{3}{4}$ " wrench ($\frac{1}{2}$ " $\times 1\frac{1}{2}$ " = $\frac{3}{4}$ ").

To determine pipe size, remember the fraction $\frac{5}{16}$ ". In the nominal sizes from $\frac{1}{8}$ " through 1", standard, extra-strong, and double-extra-strong pipe measures approximately $\frac{5}{16}$ " larger on the outside than its nominal size specification (or so close that the pipe cannot be confused for another size). Simply measure the o.d. and subtract $\frac{5}{16}$ ". Example, if pipe o.d. measures about $1\frac{5}{16}$ " : $1\frac{5}{16} - \frac{5}{16} = 1$ " nominal size.



The Easier Way to Add Fractions

$$\begin{array}{r}
 3 \cancel{\frac{1}{4}} \leftarrow 1 \\
 3 \frac{5}{16} \\
 2 \cancel{\frac{1}{2}} \leftarrow 1 \\
 1 \frac{13}{16} \\
 2 \cancel{\frac{1}{4}} \leftarrow 1 \\
 7 \frac{1}{8} \\
 5 \frac{5}{64} \\
 8 \cancel{\frac{7}{8}} \leftarrow 1
 \end{array}$$

$$\begin{array}{r}
 3 \\
 3 \cancel{\frac{5}{16}} \leftarrow 1 \\
 2 \\
 1 \cancel{\frac{13}{16}} \leftarrow 1 \frac{2}{16} \frac{1}{8} \\
 2 \\
 7 \\
 5 \frac{5}{64} \\
 8
 \end{array}$$

$$\begin{array}{r}
 3 \\
 3 \\
 2 \\
 1 \\
 2 \\
 7 \\
 5 \\
 8 \\
 \hline
 31
 \end{array}
 \quad
 \begin{array}{r}
 1 \\
 1 \\
 1 \frac{1}{8} = \frac{8}{64} + \frac{5}{64} = \frac{13}{64} \\
 \frac{1}{3} \\
 31 + 3 + \frac{13}{64} = 34 \frac{13}{64}
 \end{array}$$

1. Cancel out fractions that add up to whole numbers. Jot down the whole numbers.

2. Pick up more whole numbers, where possible, leaving fractional remainders (see above).

3. Finally, convert the remaining fractions to common denominators and add everything.

Squaring Numbers Ending in 5

The answer will always end in 25. If number has only 2 digits, add 1 to the first digit and multiply this by the original digit. For example, to square 45 in your head, add 1 to the 4 = 5. Now, 5 times the original 4 = 20. Write the 20 in front of the predetermined 25, and you get 2,025, the square of 45.

A bigger number, like 105, is squared by adding 1 to all but the 5, as here: $10 + 1 = 11$; $11 \times 10 = 110$. The 110 combined with 25 is 11,025, and that easily you've got your answer.

Engine Displacement

To find the equivalent displacement of a foreign car, remember that one liter (1,000 cubic centimeters) equals 61 cubic inches. So just multiply the displacement in liters by 61. For example: a $1\frac{1}{2}$ -liter engine will be (1.5×61) about $91\frac{1}{2}$ cu. in.

Mental Way to Halve Mixed Fractions Quickly

DO THIS:

Reduce the whole number by 1

Divide this by 2 to get the new whole number

Add numerator and denominator to make a new numerator

Double the old denominator to get the new one

EXAMPLE

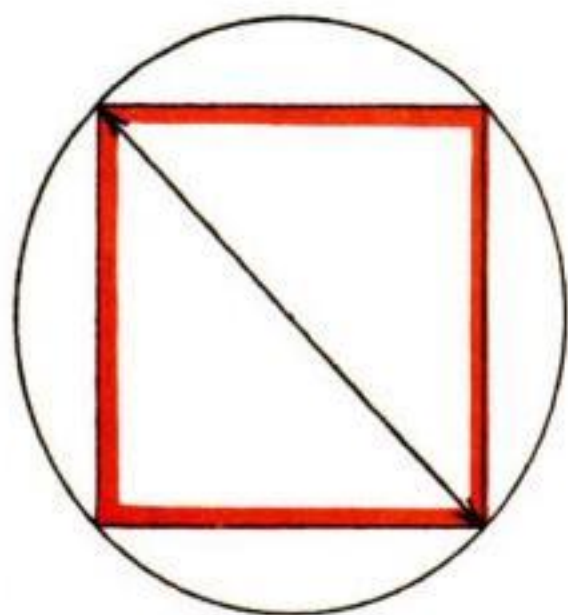
$$\begin{array}{r}
 7 \frac{2}{3} \\
 \text{LESS } 1 \\
 \hline
 6
 \end{array}$$

$$3$$

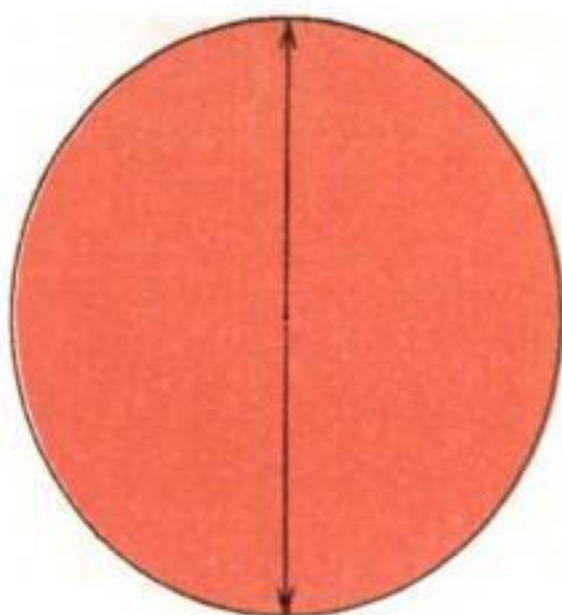
$$3 \frac{5}{6}$$

$$3 \frac{5}{6}$$

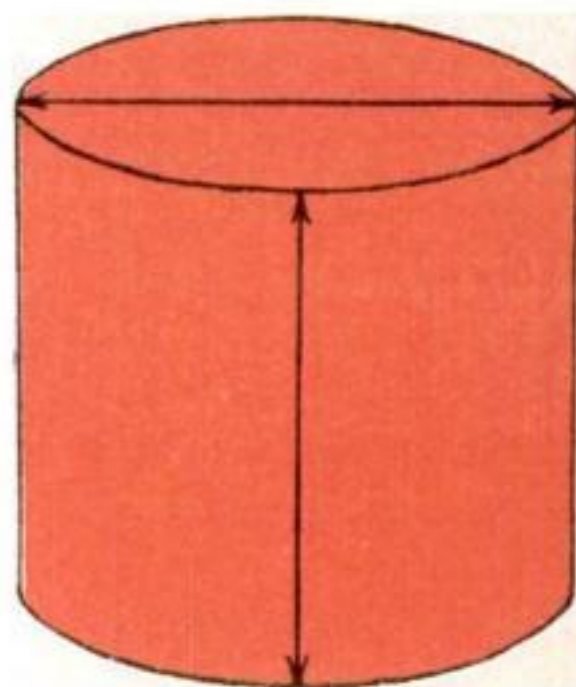
For Circles, Remember .7 Plus



Side of inscribed square equals .71 times the diameter of the circle that it inscribes.



The area of a circle equals .79 times the diameter of the circle squared.



The volume of a cylinder equals .79 times the diameter squared times the length of the cylinder.

How Many Concrete Blocks?

Find out the easy way. If they're standard $8 \times 8 \times 16$ blocks, multiply the wall height by the length. Multiply the result by 1.2. Answer is the number

of blocks required. For example, to find out how many blocks to buy for a wall 16 feet long by 8 feet high: $16 \times 8 \times 1.2 = 154$ blocks, approximately.

A Pint's a Pound, the World Around



The old axiom is a good rule-of-thumb reminder for most practical purposes to determine liquid weights. Actually, a pint of water weighs just a fraction of an ounce over a pound. Pints of most watery fluids will tip the scale at just about a pound. Oil, gasoline, kerosene, turpentine, and similar fluids weigh just under a pound a pint.

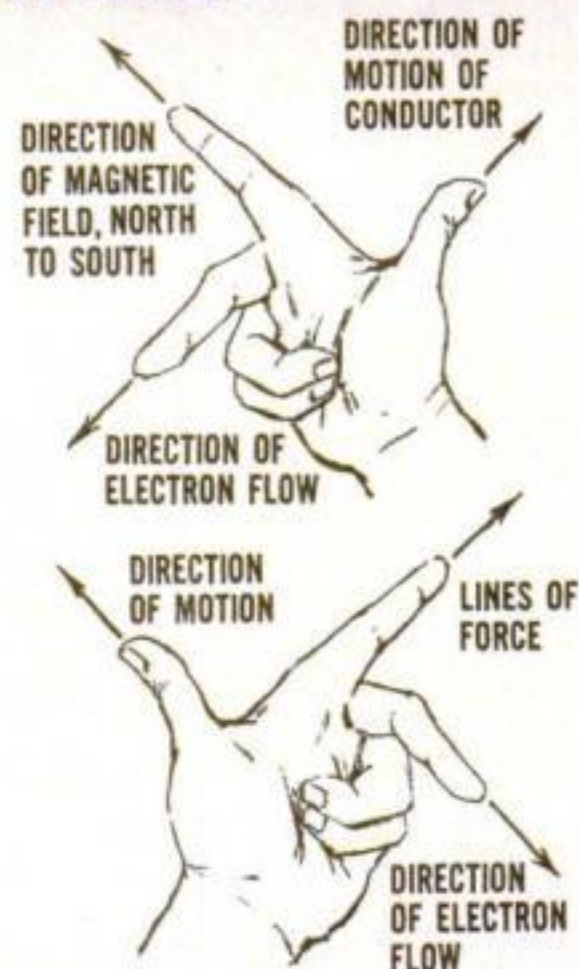
Double, Double, Toil Without Trouble

Doubling the diameter of a circle multiplies its area by four. Doubling a pipe diameter increases its capacity by 4 times.

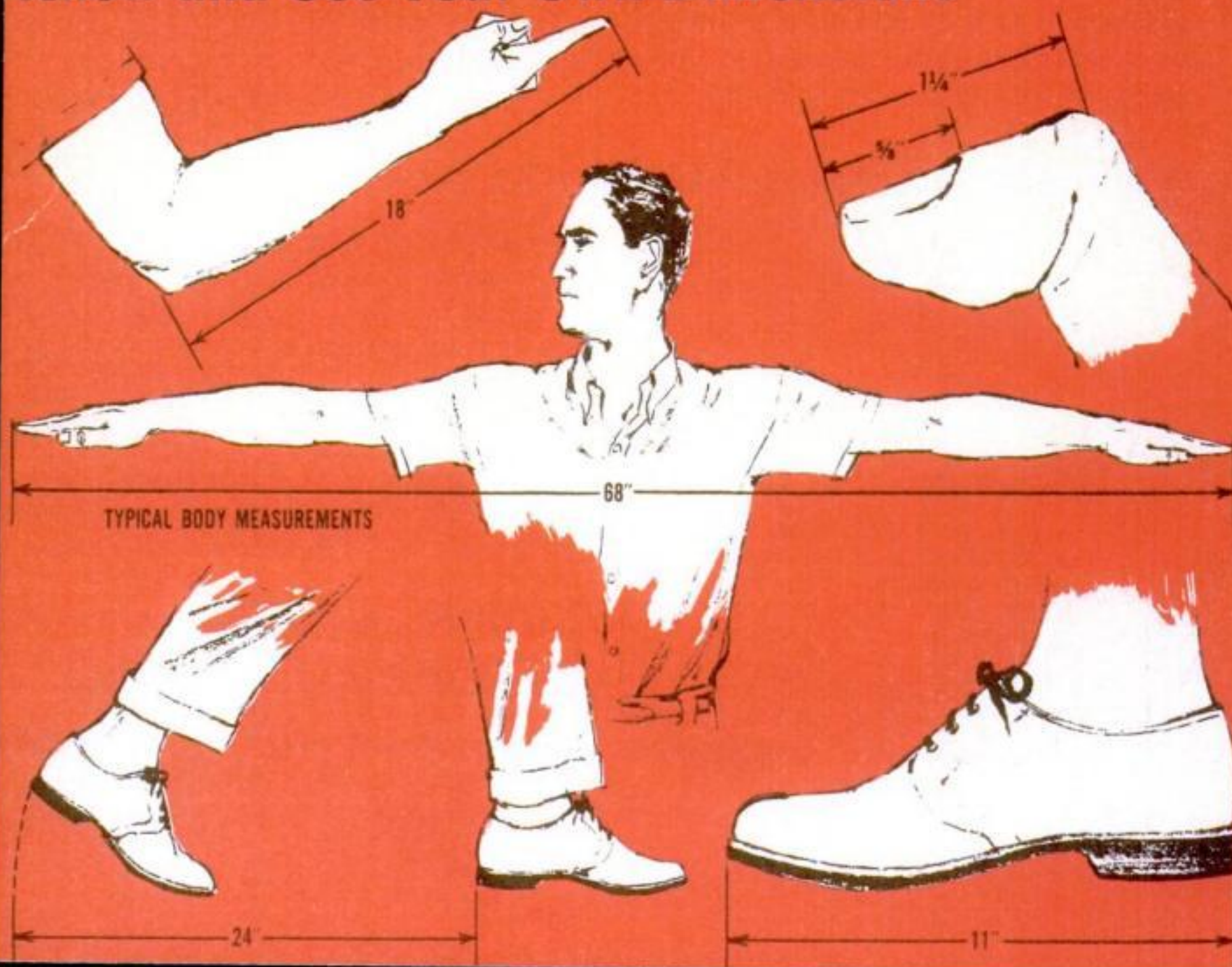
Two Rules That Need Thumbs

The right-hand rule for electromagnetism is helpful in remembering the principle of electric motors, solenoids, bells, buzzers, some relays, electric clutches, and the like; determining the direction of magnetic fields, current flow, etc. Bend the right hand to the shape shown at the top right. Like a hitchhiker thumbing a ride, the thumb indicates the direction of *motion* of the conductor. The first finger *points* the direction of the magnetic field, north to south. The second finger tells the direction of the electron flow.

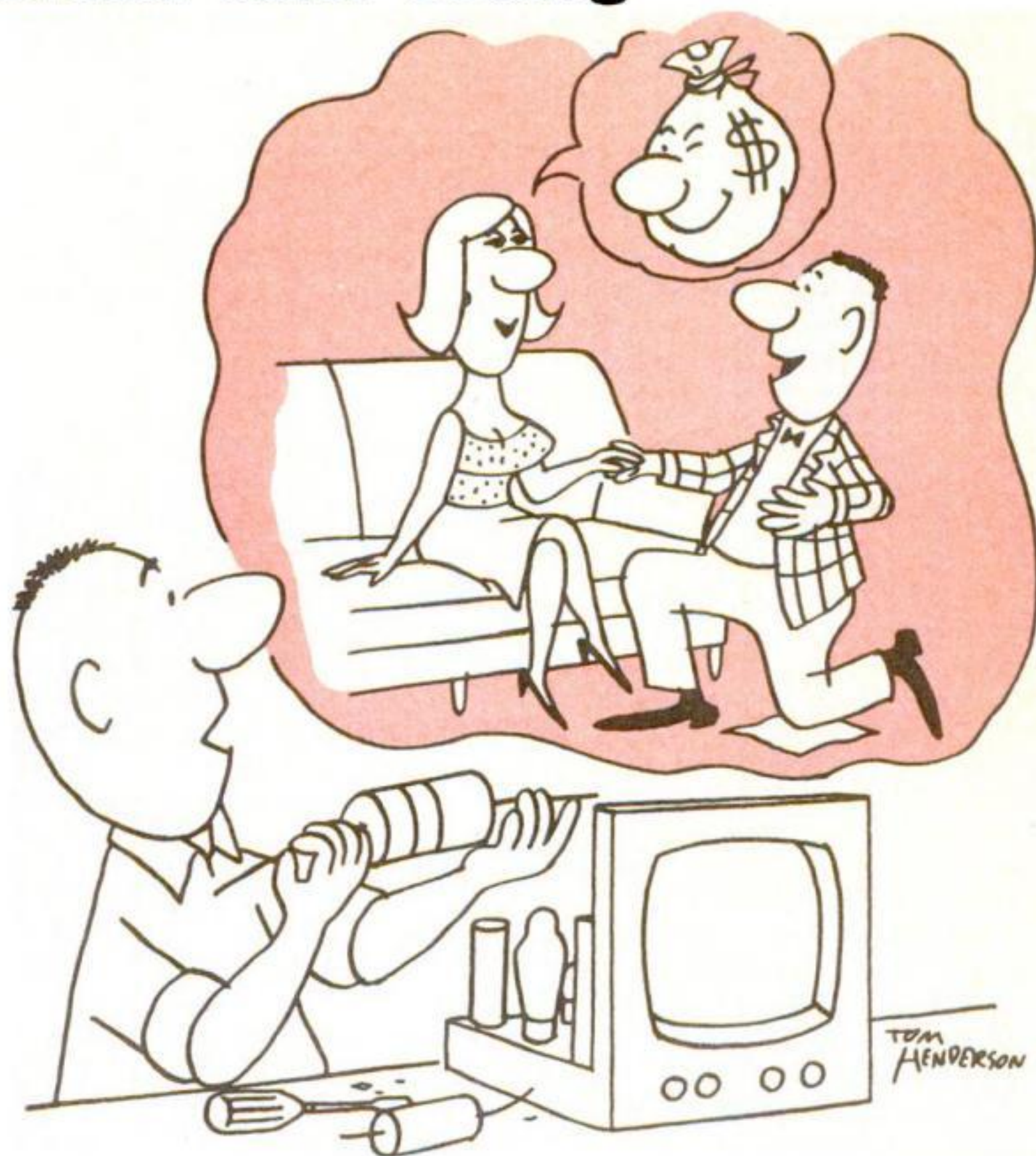
The left-hand rule for induction helps you remember what goes on when a conductor passes across a magnetic field, as in a generator. The second finger shows direction of electron flow.



For Approximate Measurements, Know and Use Your Own Dimensions



The Facts of Life About Resistor Color Coding



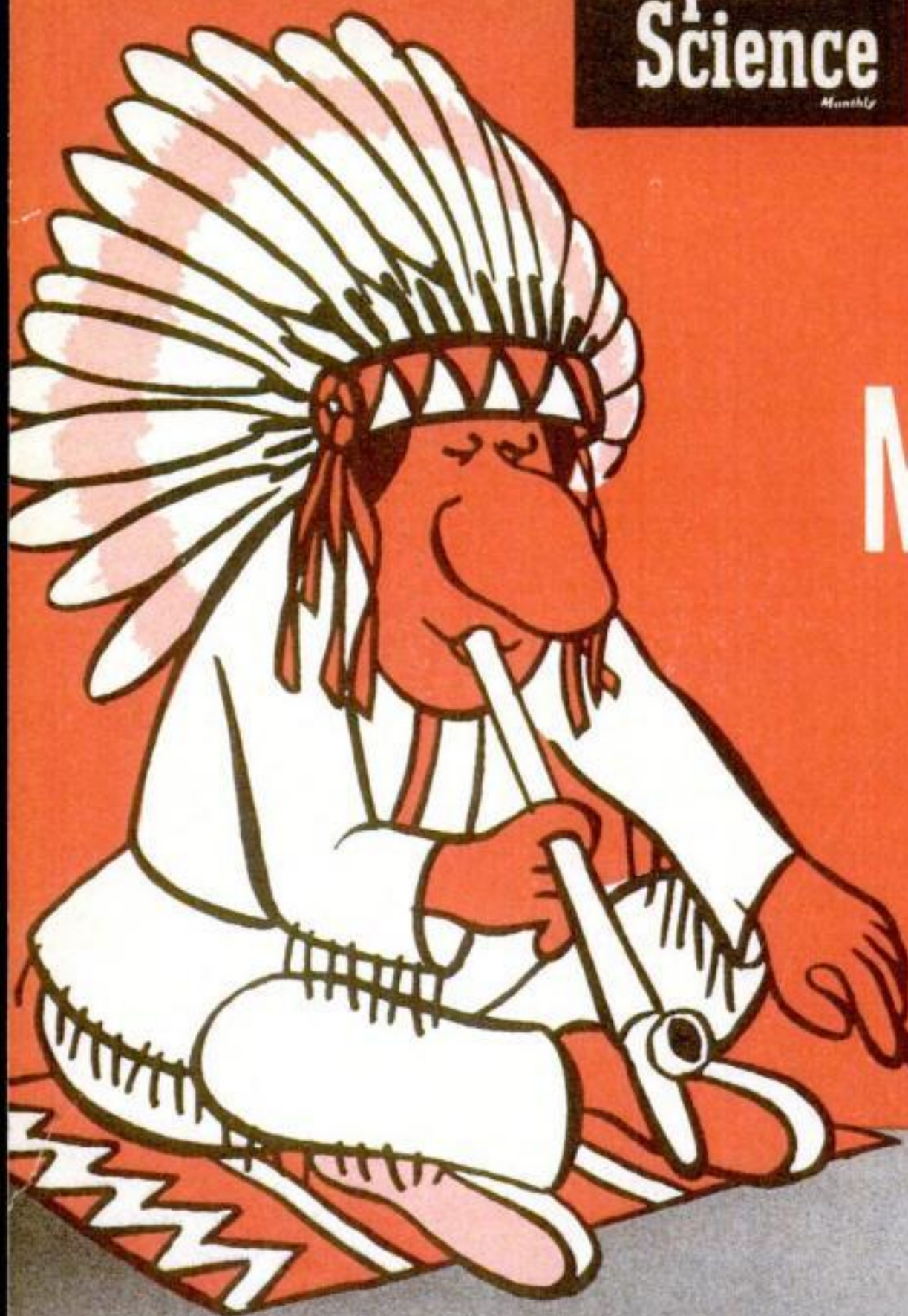
Bachelor Boys Rush Our Young Girls, But Veronica Goes Wild (only for) Silver (or) Gold

Veronica is a gold digger. But she's also your clue to the rule about resistor color coding: The colored bands are read from the left, with black meaning 0, brown 1, red 2, etc., as below.

Bachelor = black for zero; *Boys* = brown for 1; *Rush* = red for 2; *Our* = orange for 3; *Young* = yellow for 4;

Girls = green for 5; *But* = blue for 6; *Veronica* = violet for 7; *Goes* = gray for 8; *Wild* = white for 9; (only for) *Silver* = itself, 10-percent resistance tolerance (or) *Gold* = itself, 5-percent tolerance value. The first two bands give the significant figures; the third band, the multiplier.

Math and Memory Short Cuts



Remember Chief SOH-CAH-TOA

and you'll have no trouble remembering the functions needed for working trigonometry problems.

His name is derived this way:

$$S = \frac{O}{H} \quad C = \frac{A}{H} \quad T = \frac{O}{A}$$



Or spell it out, and you get:

$$\text{SINE} = \frac{\text{OPPOSITE}}{\text{HYPOTENUSE}}$$

$$\text{COSINE} = \frac{\text{ADJACENT}}{\text{HYPOTENUSE}}$$

$$\text{TANGENT} = \frac{\text{OPPOSITE}}{\text{ADJACENT}}$$

Simple? Sure. And this booklet's crammed full of other useful memory aids

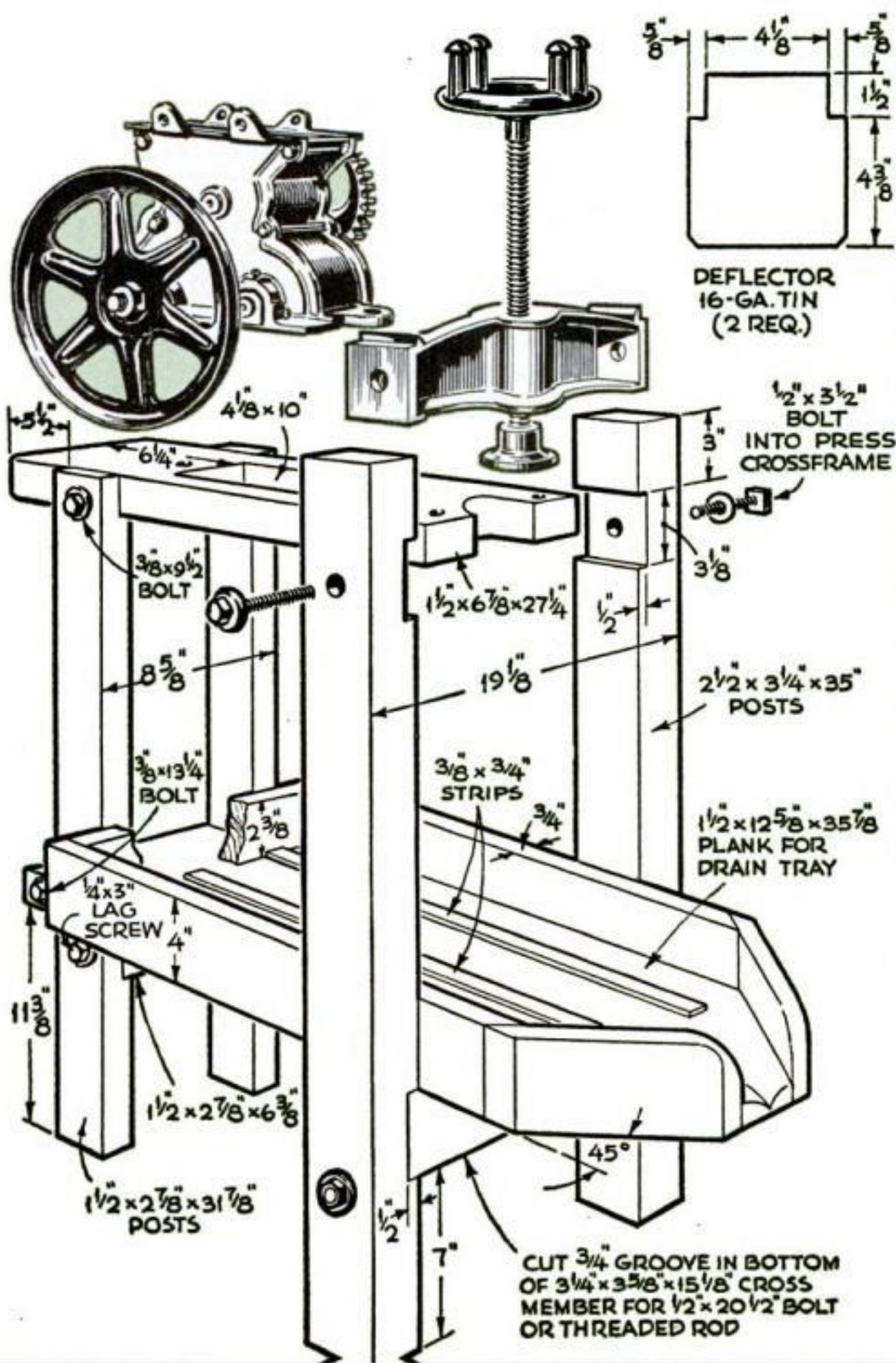
and the manufacturer's name decorating outside surfaces. All it needed was cleaning and oiling to put it into operating condition.

But the original oak frame and barrels had deteriorated beyond repair. These I replaced with new parts made of fir and pine. I added a modern touch—a washing-machine motor (not counted in the restoration cost) to drive the rollers that chop the apples.

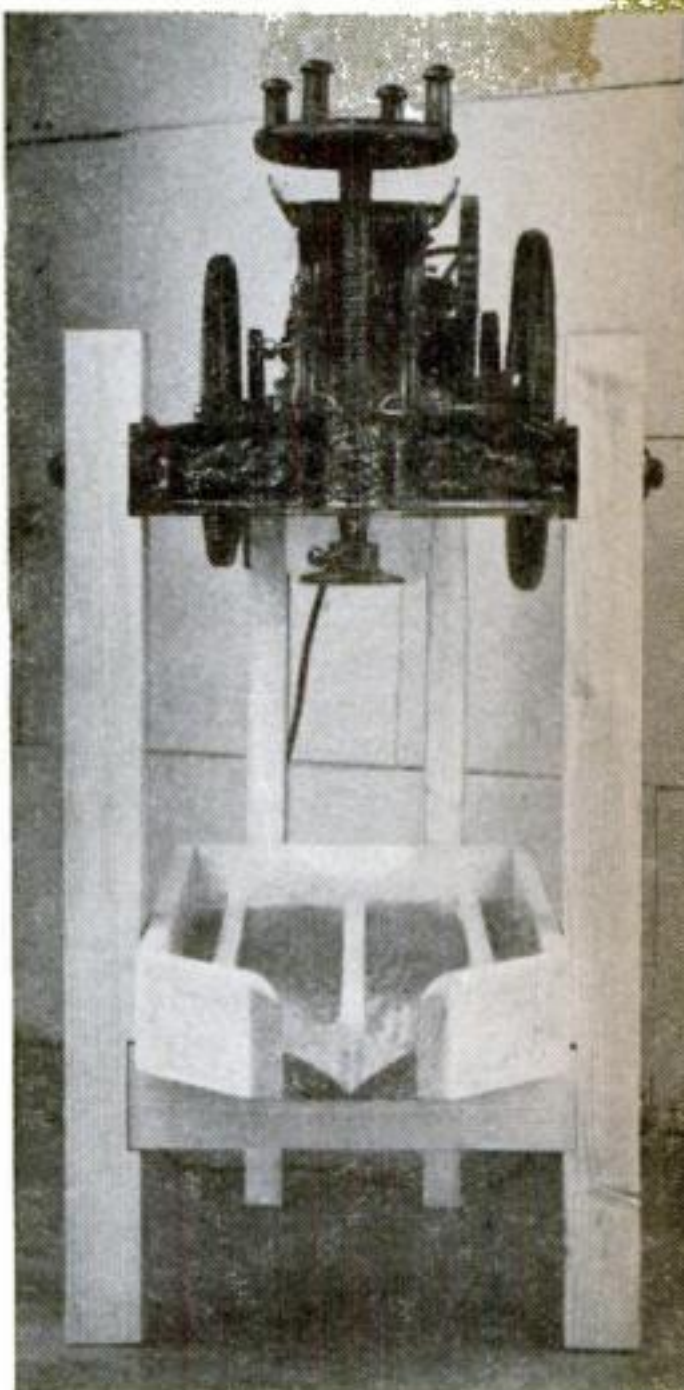
For the benefit of those who have or may find one of these presses lying unused throughout the country (thousands were made), the details of the restoration are shown in the photos and drawings.

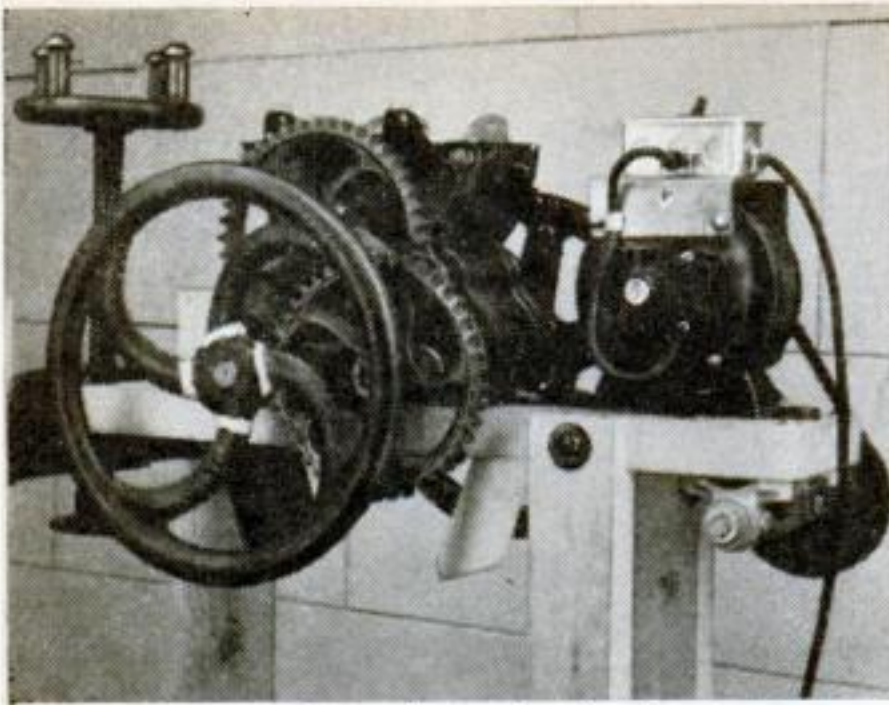
A PS Winter Workshop SPECIAL

You'll be carrying on an old American tradition when you use the press. Line each barrel with a muslin bag rolled over the rim and place one of the barrels in the drain tray beneath the chopping roll-

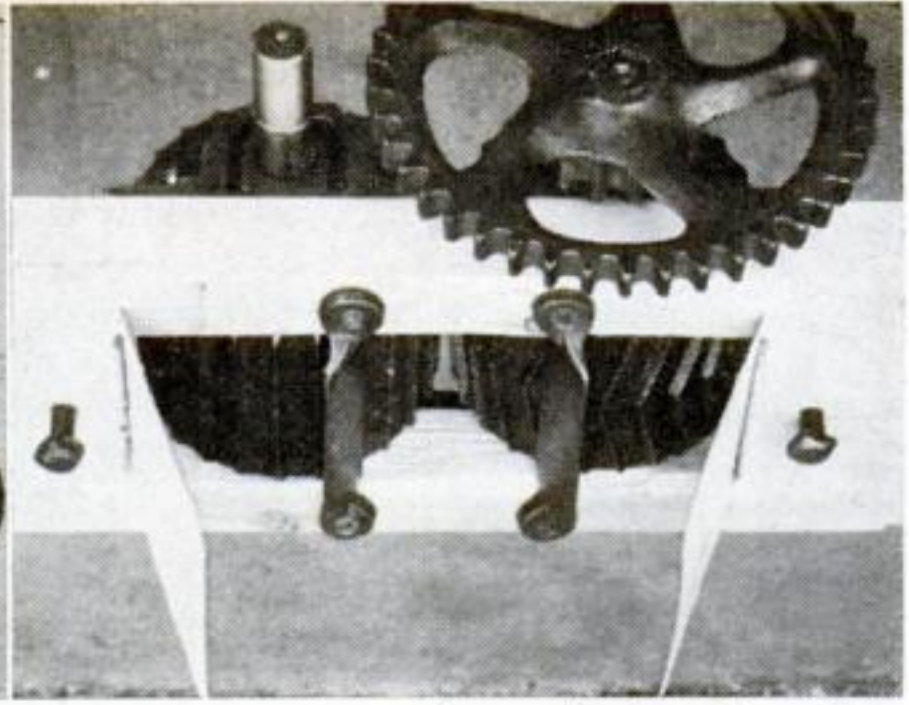


MASSIVE FRAME of fir and pine was built to replace old, broken oak frame. Cross members are set into dadoes cut in uprights for maximum strength to withstand pressing strain.

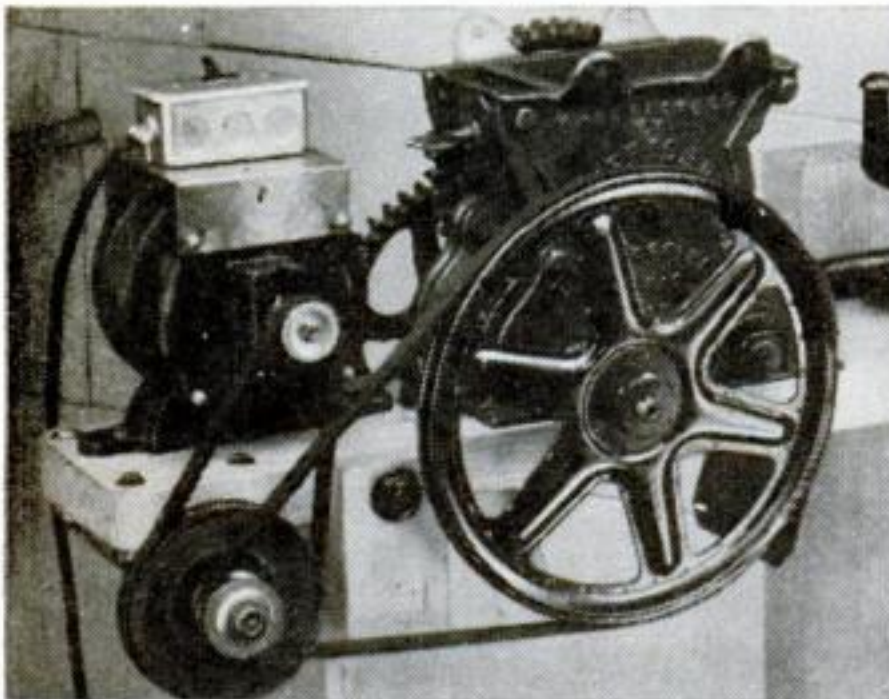




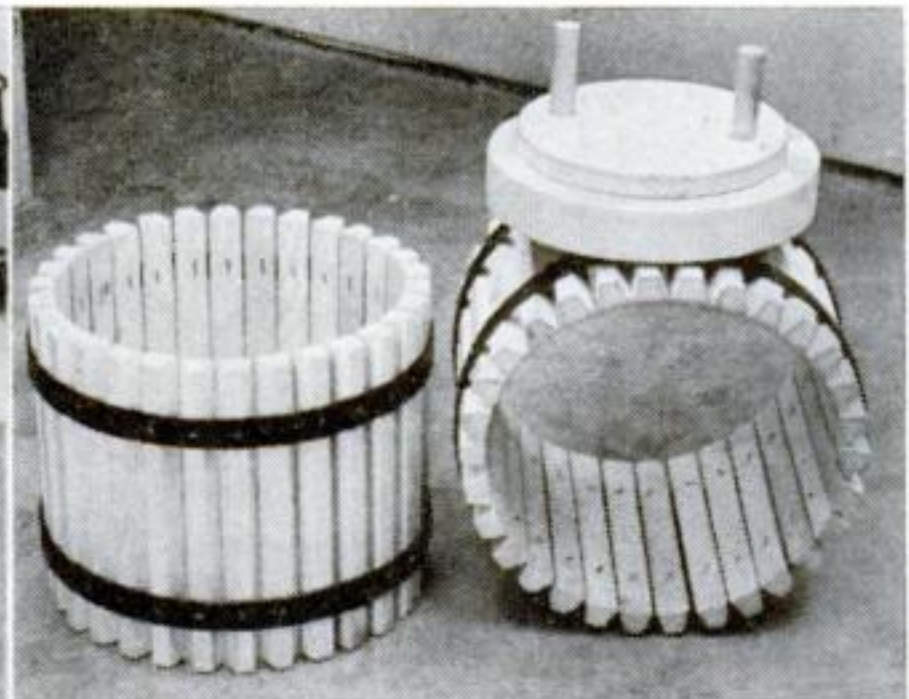
CHALK MARKS show where the flywheel was cut down to its hub when the motor was added. If hand crank had been retained, flywheel would be necessary to smooth out cranking effort.



VIEW FROM BENEATH shows the chopping rollers and the two scraping strips that clean pulp from the rollers. Two tin deflectors channel chopplings into the barrel beneath the rollers.



MOTORIZED, the chopping part of the press makes short work of preparing apples for the big squeeze. Pulley sizes shown are 1½" on motor, 2" and 6" on jackshaft, 12" on machine.



BARRELS have 30 staves each. These are bound together with ⅛"-by-1" steel bands. Flathead nails driven through holes drilled in the bands are clinched or bent over on the inside.

ers. Load the hopper with the juiciest apples you can get and turn on the motor—or crank the handle if you've kept out the modern influence.

When the barrel is filled with chopped apples, move it under the screw press and close the muslin bag. Place the pressure lid over the bag and screw down the press until it begins to squeeze hard on the apples. Apply final pressure with a stick about the length of an axe handle,

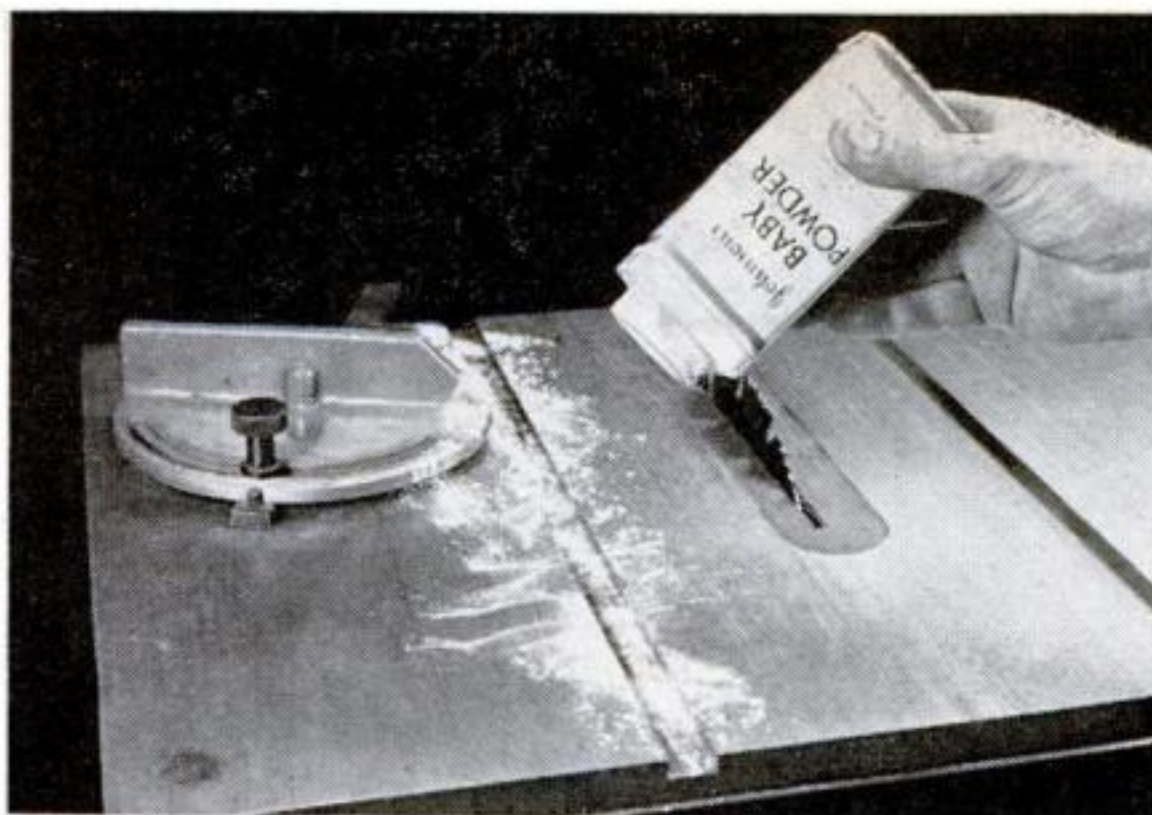
placed between the pins on the press handwheel, to drain every last drop into a bucket placed beneath the mouth of the tray. If you've installed a motor, the second barrel can be filling beneath the rollers while you're pressing the first. After each load, discard the squeezed-out pulp and rinse the muslin bag.

What you do with the "squeezin's" is your affair, but you're missing a bet if you don't do as Grandpa did. ■ ■

Safe Support for Painting Storm Windows

THE best way to paint both sides of storm sash is to support the frame by its glass. Then the wet side doesn't touch anything when you flip it over. Two saw horses will provide such support if you

cut four 3' sections from an old tire casing and slip a pair of them over each cross bar. Space them so their outside edges fall inside the frame of the window.—G. E. Hendrickson, Argyle, Wis.



Shop Tips

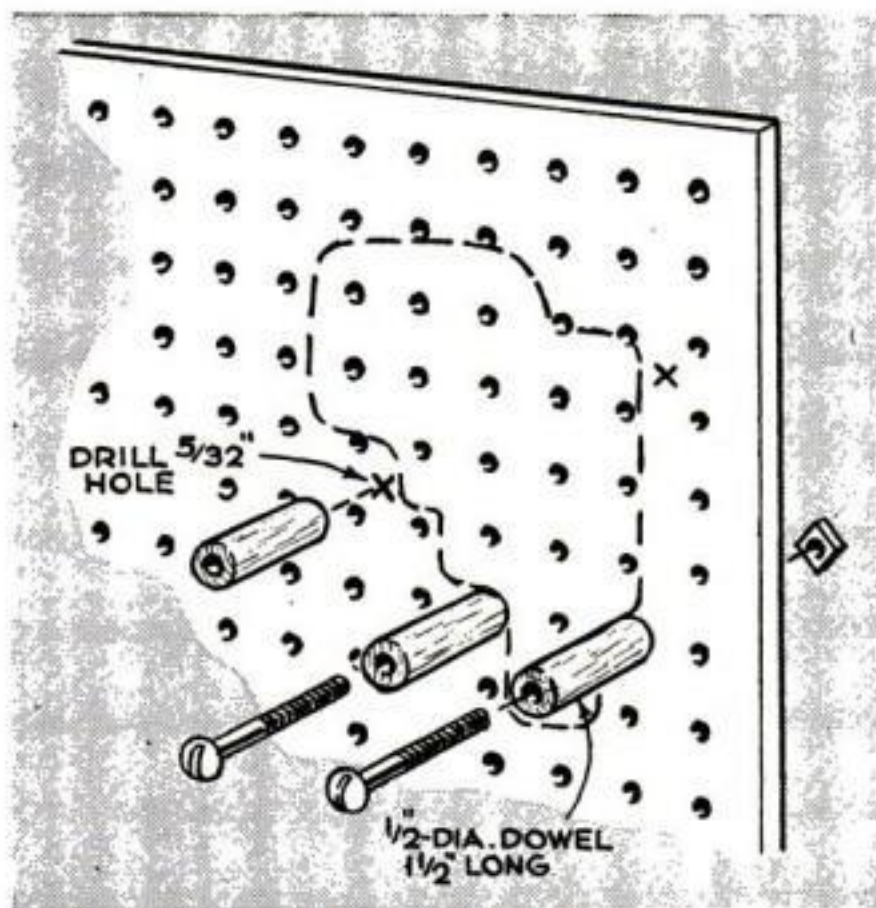
FROM PS READERS

Lubricating a Miter Gauge

THERE'S danger of staining the work when you lubricate a sticking miter gauge with oil, grease, or graphite. Instead, sprinkle a little talcum powder in the channel.—H. J. Gerber, Stillwater, Okla.

►►►FOR sharp bends in soft sheet metal (aluminum, copper, zinc), score with a wheel-type glass cutter along a straight edge. Increase pressure on successive passes until line is deep enough to bend clean.—Francis R. Young, Jackson, Mich.

►►►DON'T toss out old sash cord. Chop off a 6" length and fray one end for use as a glue brush. Instead of cleaning bristles when a job's done, discard the used piece and cut off another for next time.—Francis R. Young, Jackson, Mich.



Holder for Portable Drill

You can buy brackets for mounting most hand tools on a tool board, but I've found the following method best for keeping my electric drill at hand.

Trace an outline of the tool on the board, and drill holes at three or four suspension points. If the tool board is perforated hardboard, you may be able to utilize several of the existing holes. Cut and drill short lengths of dowel, and bolt them through the tool board.—George E. Sparks, Chillicothe, Ohio.



Safe Storage for a Torch

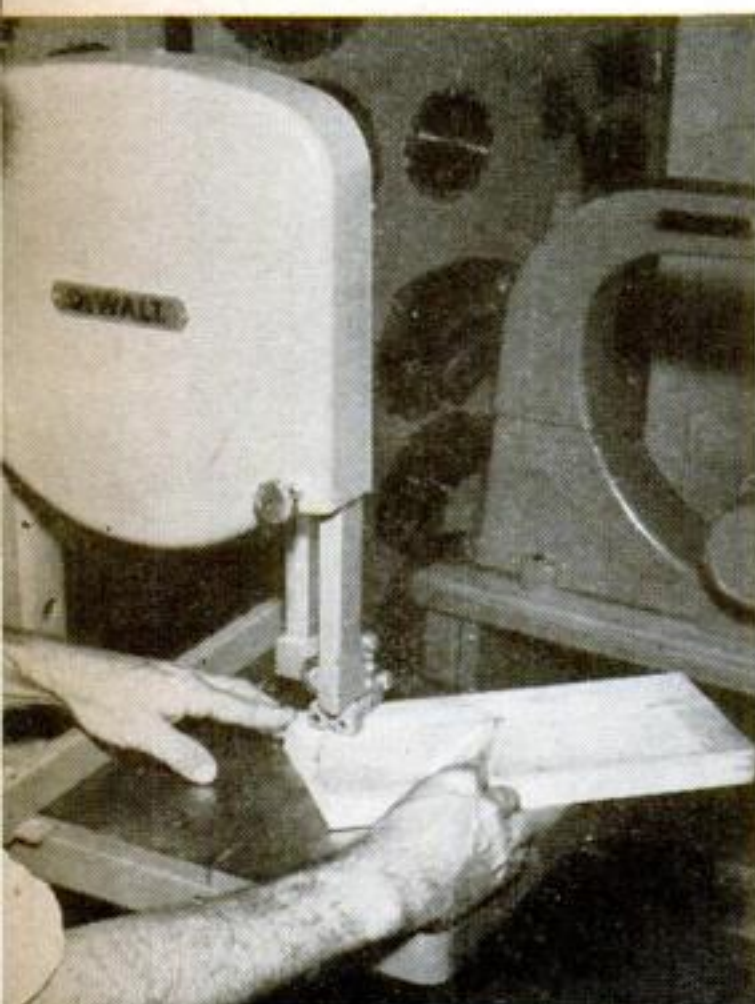
KEEP your propane hand torch off the workbench and out of a child's reach by providing a wall pocket for it. Nail a tin can to the wall by its attached lid.—William B. Eagan, Maceo, Ky.

HOME SHOP news report

By
Sheldon M. Gallagher

A PS Winter Workshop SPECIAL

**For familiar
tools, shiny
new name plates**



Big changes in the tool world: Walk into a hardware store this fall and you'll be in for some surprises. You'll find familiar tools with unexpected labels, and unfamiliar tools with strange new labels. All this is the result of vast but quiet changes taking place behind the scenes among major power-tool makers. Two recent mergers have brought together five famous names in tools. One well-known name will disappear from showrooms completely. Other names will begin appearing on tools they previously had nothing to do with.

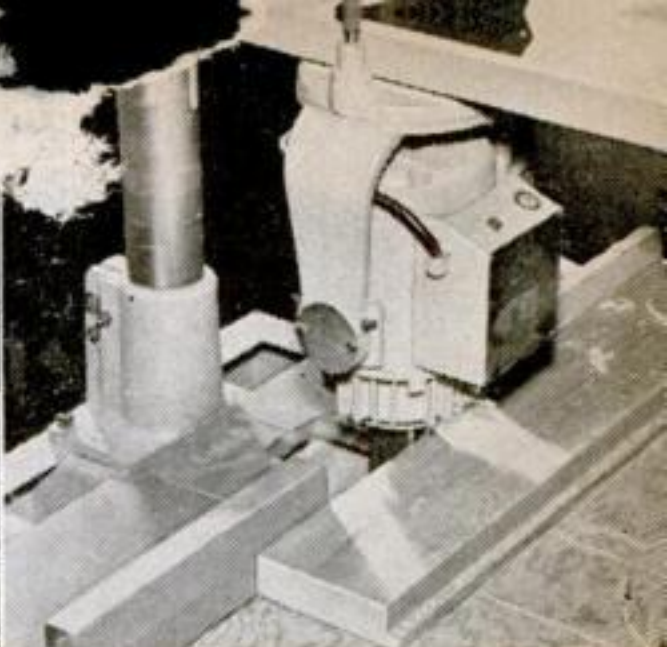
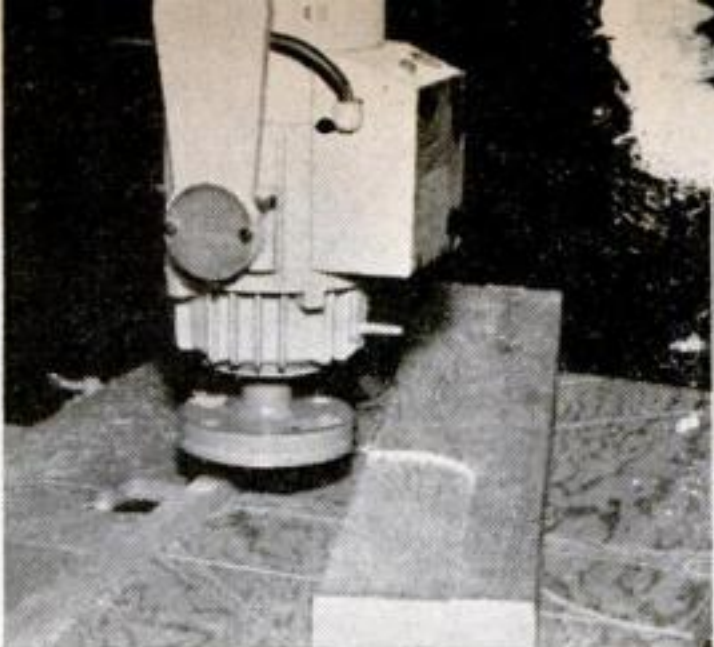
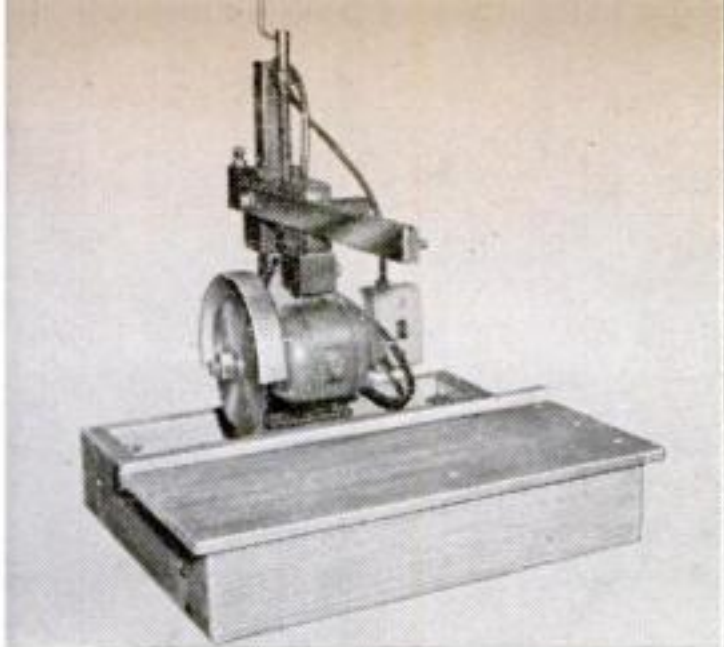
What will these changes mean? Most of them will not substantially affect the tools you buy, but you may need a program to follow the players.

New tools for Black & Decker: In two swift moves, Black & Decker, a leader in the portable tool field, has taken over DeWalt's popular radial-arm saw and the entire line of stationary woodworking tools formerly made by Atlas. This new three-way lineup now gives B & D a full stable of power tools ranging from small drills to giant lathes and drill presses.

Atlas will continue its metalworking and industrial lines, but will no longer make any home-shop woodworking tools. The distinguished DeWalt label, purchased from American Machine and Foundry, will be retained by B & D for use on eight of the former Atlas tools. These will include the 12" bandsaw and combination disk-belt sander shown at left, plus a 10" table saw, 24" jigsaw, 12" wood lathe, 15" drill press, 6" jointer, and a grinder-hone.

No major changes are planned for the new DeWalt-label Atlas tools. Replacement parts and accessories will also be available to fit earlier-sold Atlas machines. The only noticeable difference will delight buyers: They will no longer have to put together their own purchases. All of the new DeWalt versions will come completely assembled, ready to plug in. Prices are expected to remain about the same.

Black & Decker, which surprised the tool world this summer with its introduction of the first cordless electric drill, continues to make news on its own by adding a new conventionally powered saber saw this fall. Chief talking point: An unusual nylon blade guide acts as a pressure pad to prevent splintering of plywood and fine veneers. The saw will sell for about \$40. It, along with all of Black & Decker's portable tools, will continue to wear the B & D label.



DeWalt's radial-arm saw: A famed old tool takes on new jobs

FIRST RADIAL-ARM SAW, invented by Raymond E. DeWalt and introduced in 1924, looked like this. It was then called the "Wonder-Worker"—and craftsmen would agree that it still is.

NEW PLANING ACCESSORY for modern DeWalts is a two-knife rotary cutter that mounts on the saw-blade shaft. It will dress rough or warped lumber down to a smooth, flat surface.

FOR JOINTING, this new vertical-cutting DeWalt attachment puts a straight edge on stock up to 2" thick. It can also be used for rabbeting, as shown on outer edge of board above.

New radial-arm saw accessories: DeWalt's radial-arm saw, introduced as the world's first in 1924, will continue to be sold under the DeWalt name and is also expanding its uses. Two recent attachments, shown above, enable you to use the saw's power head as a planer and jointer.

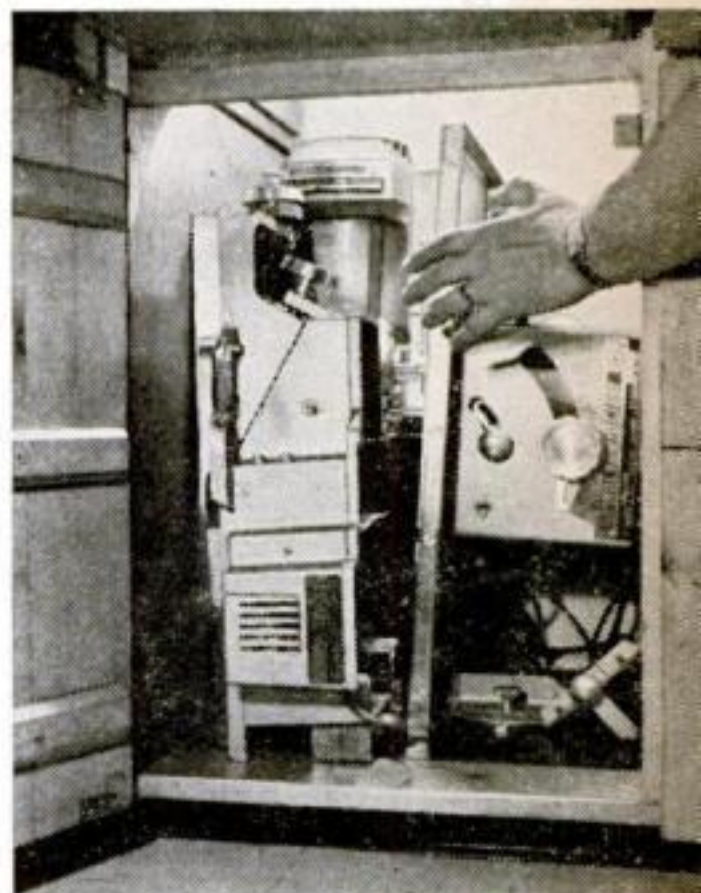
New home for Porter-Cable: In another surprise stroke, Rockwell Mfg. Co., owner of Delta, has acquired up-and-coming Porter-Cable as a stable mate for its long-successful Delta operation. With Delta's full line of stationary power tools and Porter-Cable's portable line, this gives Rockwell an across-the-board sweep similar to Black & Decker's.

Both mergers are based on a simple business philosophy: You name it, they've got it.

A new concept in tools: Rockwell, meanwhile, is expanding on its own. Borrowing a bit of successful Detroit salesmanship, it is announcing a brand-new line of "compact" tools with an eye to the home or apartment dweller who wants big-shop capacity in a small space. The slimmed-down machines, shown at right and below, will include a drill press, table saw, and jointer as starters.

CONTINUED

For compact living: A shop to fit in a closet

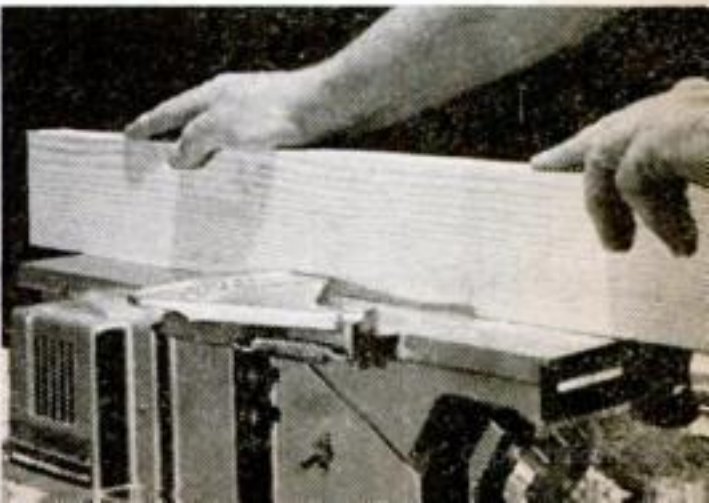
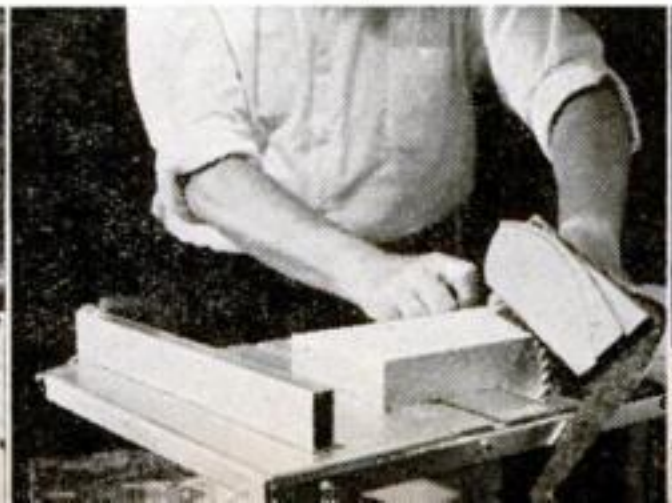


ALL THREE new Rockwell tools store in a 17"-wide cupboard.

MIDGET DRILL PRESS is only 25" high, yet has husky ½-hp. motor with three-speed drive and generous 7¾"-by-11" table. Here it is packed along in a trailer and set up outdoors.

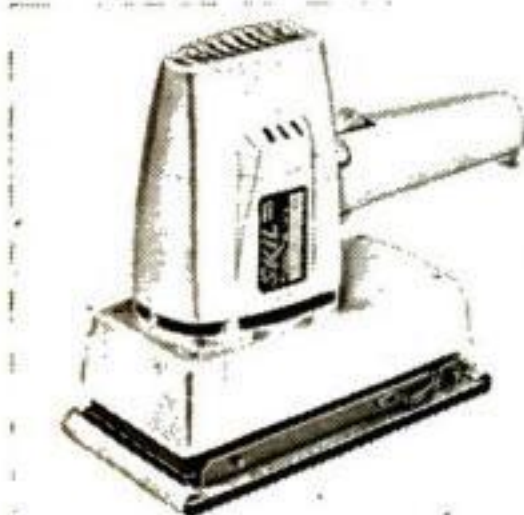
SMALL IN SIZE ONLY, this tilting-arbor table saw swings a 7¼" blade. Its ½-hp. motor is built right into base so tool can be moved anywhere with no belts to set up or wear out.

JOINTER TURNS at 4,100 r.p.m. and, like table saw, has own motor built into it. Its 4½" cutter head handles rough stock up to 4" wide. Adjustable fence tilts in two directions.





HUMOR IN A SERIOUS BUSINESS: Stanley plans to catch buyers' eyes this fall with cartoons like this by famous Ted Key.



Each tool is completely self-contained with its own built-in motor and weighs only 30 to 35 pounds. The big pitch: nothing to waste space or time setting up. Virtually an entire shop can be trotted out on a kitchen table, stored on a shelf or in a small cupboard.

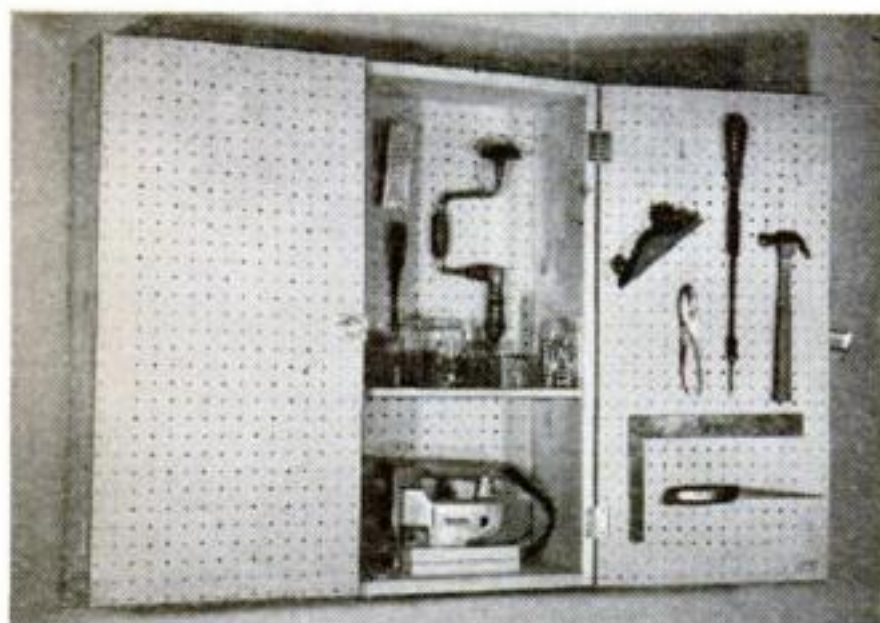
Significantly, the new compact tools will be sold under the Rockwell—not Delta—label, a move aimed at drawing attention to the growing Rockwell name. An unusual pricing scheme is designed to tempt buyers with a straightforward, no-nonsense appeal: A flat 80 bucks takes home any of the three machines, complete with motor and nothing else to buy.

Quick way to build a tool cabinet: Stanley Tools, already involved in far-flung hand-tool and portable-tool operations, is also expanding its hardware line. For Christmas sale, they're taking the wraps off a set of cabinetmaking hardware, shown below, that's designed to give you in one package everything needed to build a storage cupboard.

"No pickle factories for us." Skil Corp., famous for its introduction of the portable circular Skil-saw in 1924, has been steadily broadening its line of portable tools. New within the past year is its "500" line of style-matched tools, including the streamlined orbital sander at left, a saber saw, companion hedge and grass trimmers, and a compact $\frac{1}{2}$ " electric drill

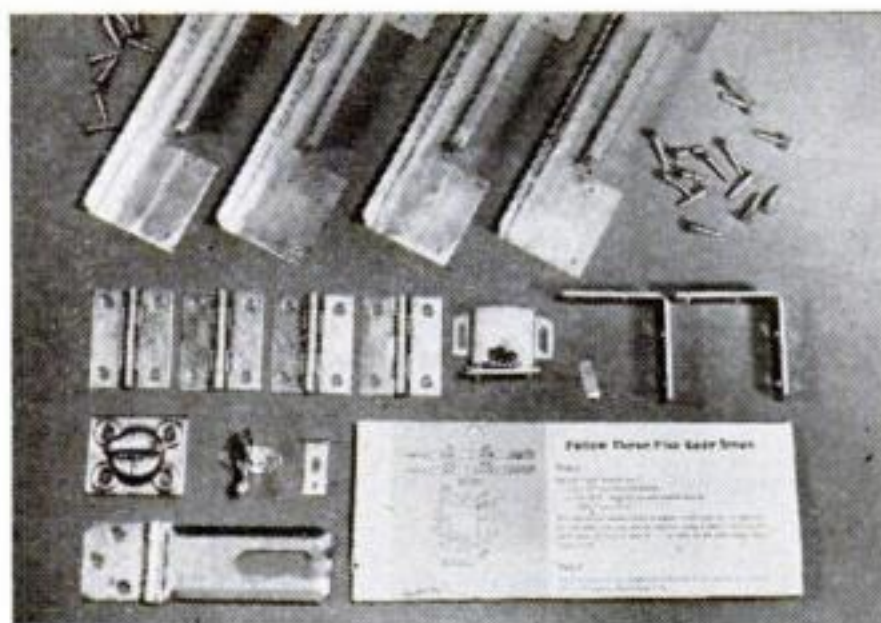
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New hardware builds a tool cabinet in a few minutes



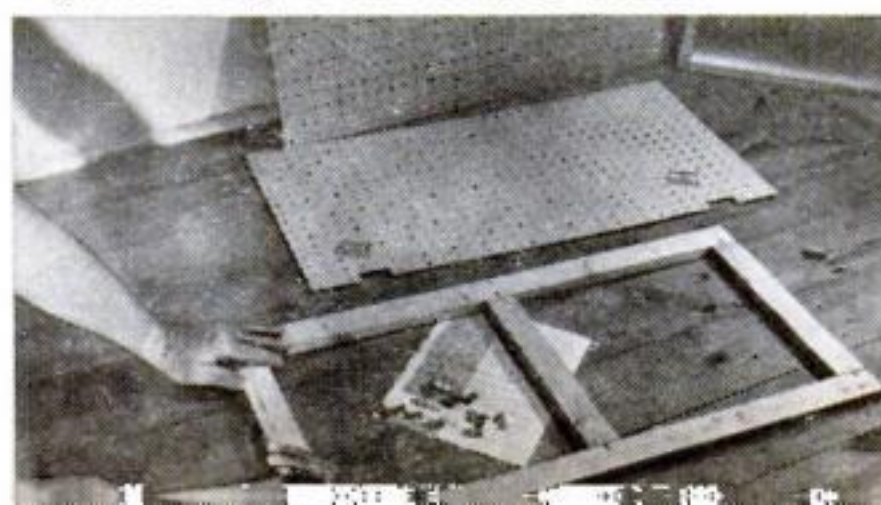
ANY SIZE CABINET can be built with new Stanley kit because parts are flexible, fit any size lumber. Cabinet here is spaced off wall with cleats to let tool hangers clear in back.

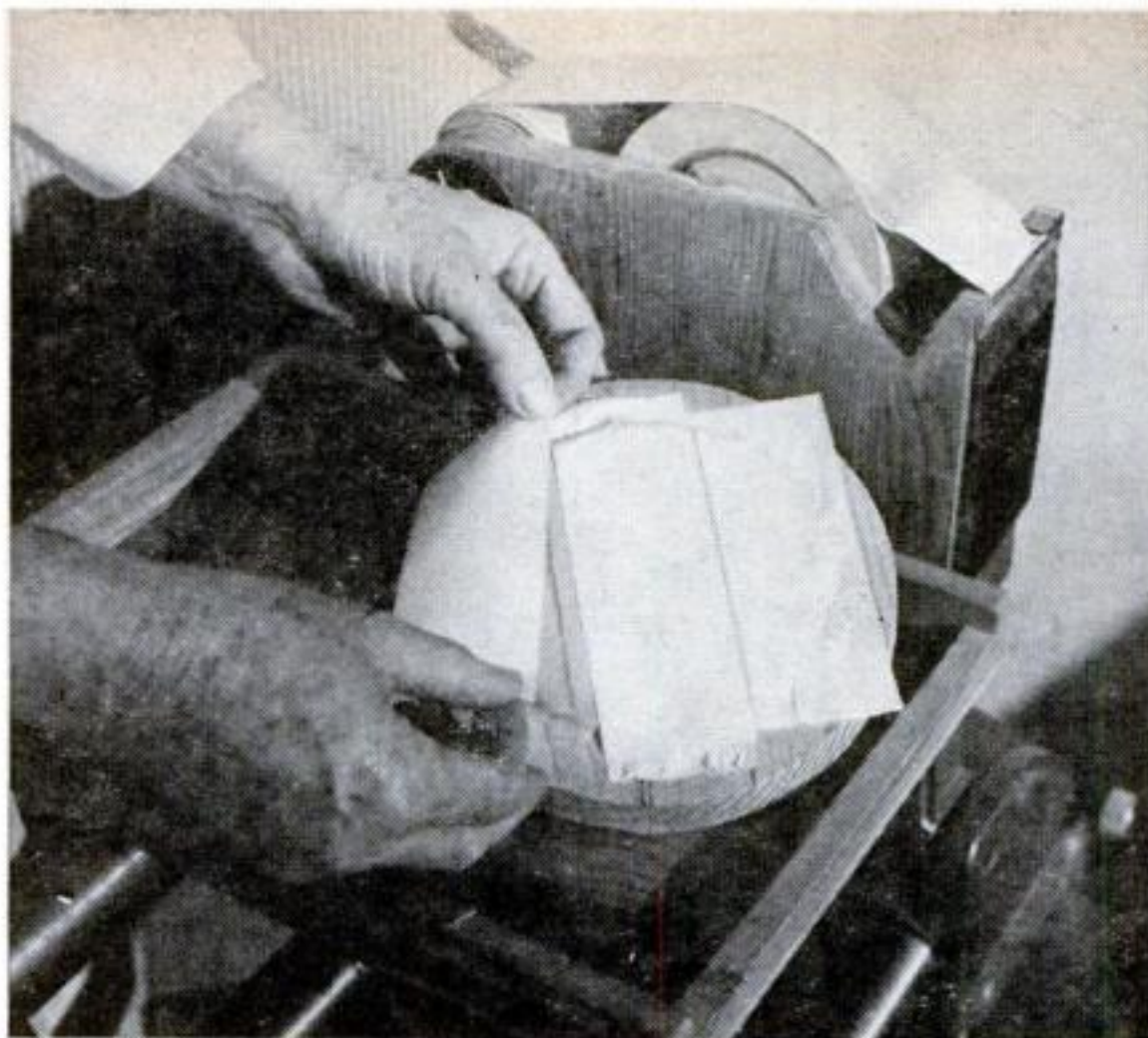
INTERLOCKING CORNER BRACKETS make strong joints quickly. Tabs hook over each board to carry loads, are nailed on through predrilled holes. Open ends take any stock lumber widths.



KIT AS YOU BUY IT includes four corner brackets, magnetic latch, hasp for padlocking, hinges, and screws. Special Christmas price is \$2.95 from Stanley Tools, New Britain, Conn.

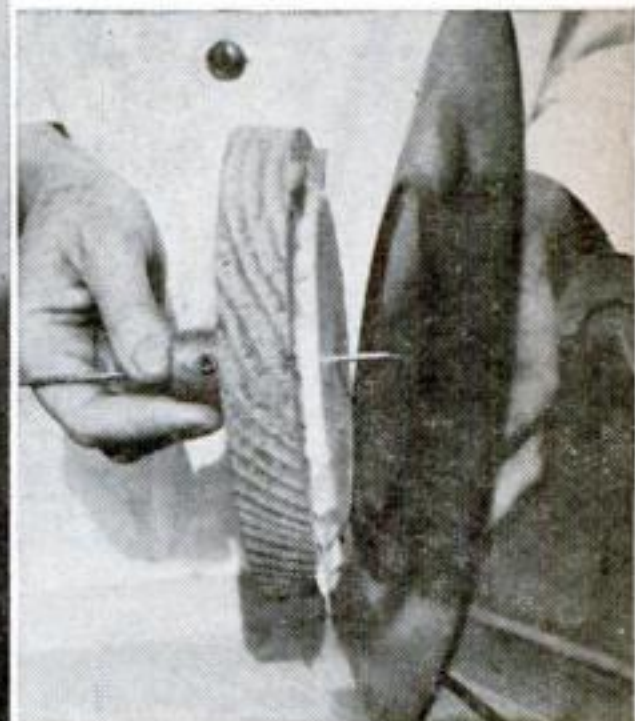
CABINET DOORS can be solid or built up like this. Perforated-board panels over a simple one-by-two frame provide hollow spaces for inserting tool hangers on inside of doors.





Shop Tips

FROM PS READERS



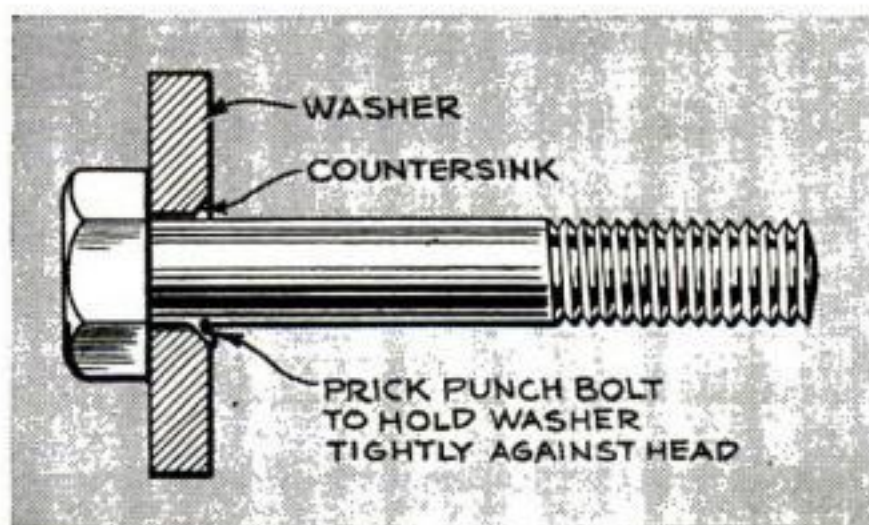
Trick for Two-Sided Turning

WANT to copy a china plate on the lathe? It's not hard to work both sides of a thin turning blank, if you know this trick: Screw the blank to a faceplate, and shape the underside first—complete with the familiar recess. When this area is flat and smooth, make a pinpoint depression in the exact center. Apply lacquer or another hard finish.

You can now shift the tool rest and shape as much of the top surface as the faceplate will allow. Remove the work

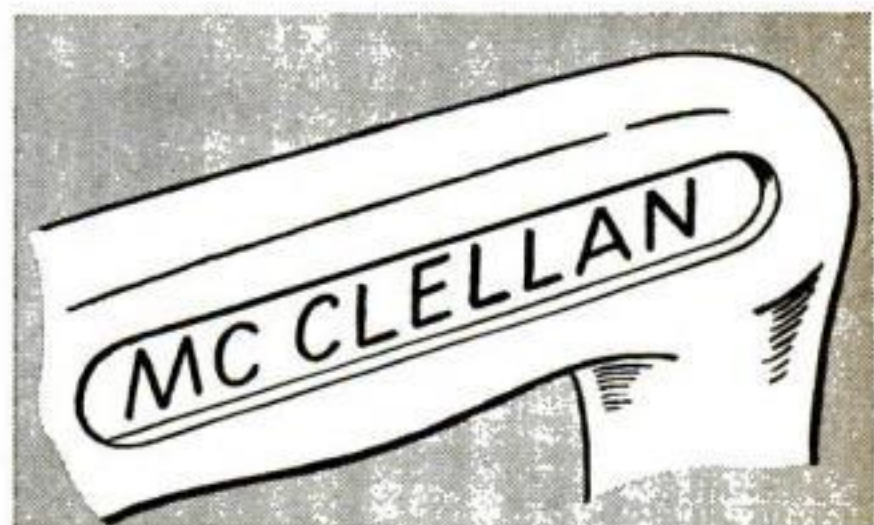
from the faceplate, replacing it with a scrap disk of a thickness to match the depth of the recess. Turn this down so it fits snugly into the recess and drill a small hole through the center.

Remove from the lathe, and cover the disk with strips of double-faced masking tape. Press this firmly into the recess, aligning the centers by means of a pointed rod, as shown. Remount the faceplate in the lathe and complete the top side of the blank. (Don't try to work the back, though.) When finished, peel the plate free.—A. E. Dally, Hawthorne, Calif.



Locking a Washer on a Bolt

THERE'S a simple way to keep a washer on a bolt or screw without welding. Countersink the hole before inserting the bolt. Stand the bolt on its head and tap a prick punch into the shank, as close to the washer as possible. Three burrs lock the washer in place, yet allow it to turn.—Frank LaSaracina, Yonkers, N.Y.



Wearproof Name on Tool

YOUR name won't wear off a metal tool if you rout a recess for it. Whenever I get a new tool, I set it in the milling machine and take a 1/16" cut with an end mill. I print my name on the bottom of the recess, using a small paintbrush, an etching pencil, or a scratch awl.—H. C. McClellan, Willow Grove, Pa.

A PS Winter Workshop SPECIAL

Miracle Hi-Fi Speaker?

Some Builders Think So

Early this year English papers and magazines published enthusiastic reports about a "mystery" loudspeaker enclosure developed in Wales. The enclosure described was simple and easily made, yet excellent results were claimed. Since many U.S. hi-fi fans might like to build and try out the enclosure, we asked our London representative to visit Cardiff.

By David Scott

WHEN I called on Jabez Gough in his store in Cardiff, he led me to a back room. Opening his files, the 52-year-old radio and TV serviceman turned me loose on scores of letters from people who were tapping their feet to music from one of his speaker enclosures.

A British army colonel wrote that he got "better quality than from my costly speaker in its approved cabinet."

A South African hi-fier wrote of Gough's box, "a masterpiece of effort . . . results superb, especially for one who appreciates a balanced output with pleasing tonal qualities."

An English doctor was "amazed at the



THE DESIGNER IS A WELSHMAN who runs a TV and radio store. Gough doesn't plan to manufacture the enclosure himself, but has made up a few sets and kits for his Cardiff customers.

quality of music reproduced by a seven-shilling (\$1) government-surplus speaker." Another newly awakened audiophile compared the difference between his radio's sound reproduction and that of Gough's cabinet to that "between a mouth organ and a church organ."

But the designer is especially proud

Not 'Amazing,' but 'Good' PS Technical Editor Reports

Is the Gough speaker really as good as so many people say? We decided to ask our own expert, a man who has been a hi-fi fan right from the beginning. Here is his answer.



IN STUDIO NO. 1 over the store, Gough demonstrated the nondirectional properties of the enclosure to the author. Scott couldn't tell which of several speakers were working.



IN STUDIO NO. 2, the author found that the simple, homemade enclosure (eight rectangles of $\frac{1}{2}$ " plywood) held its own very well when pitted against some of the costliest speakers.

of praise from an eminent Welsh university music professor also connected with the BBC. He pulled out all stops: "... a more natural and realistic sound than any other form of reproduction I have heard. . ."

How do you put together a four-sided box and get such results?

Here is a mystery. The cabinet is a simple partitioned box formed of eight rectangular plywood panels. It needs only an inexpensive 8-inch speaker. The whole thing can be made by do-it-yourselfers in Britain for the equivalent of \$15.

"I haven't the foggiest idea how it works," says Gough, who left school at

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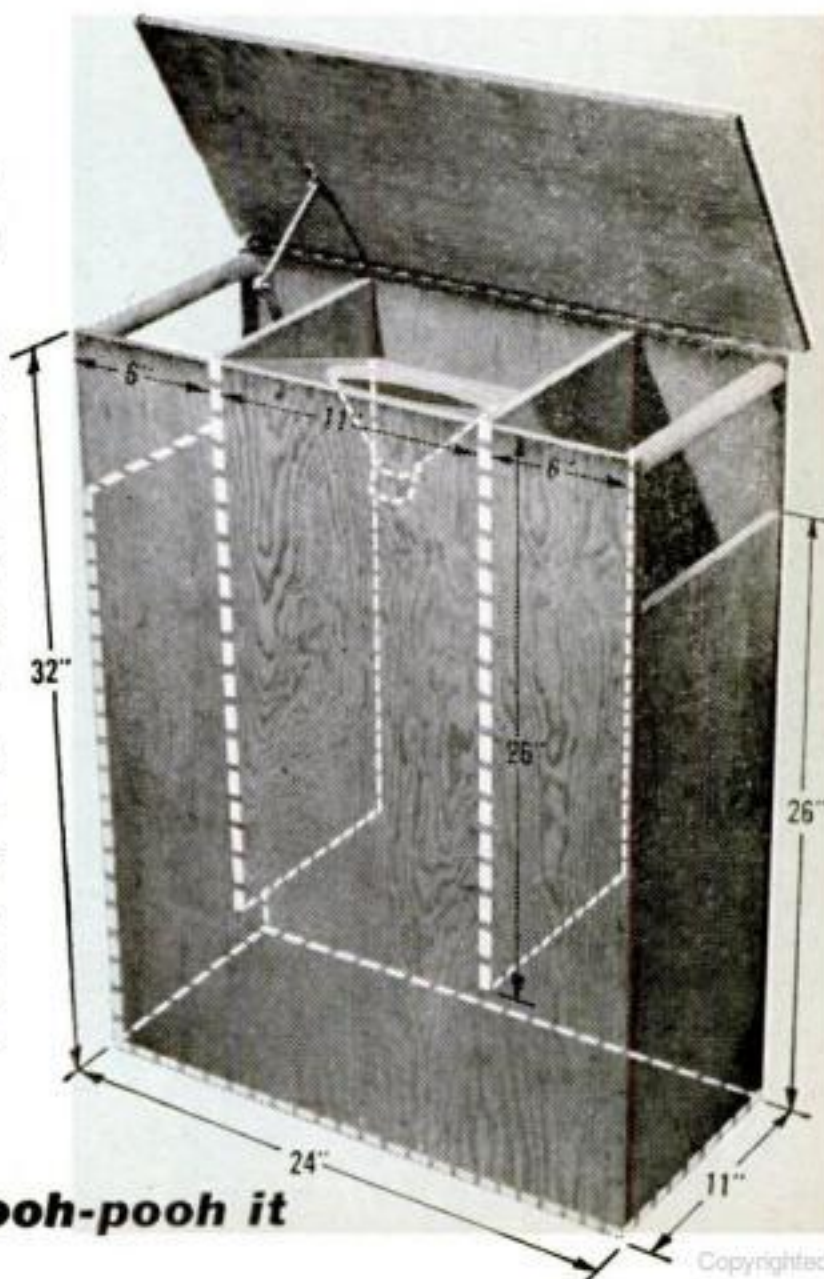
By Hubert Lockett

FRANKLY, I was skeptical as I nailed together my own version of the Gough enclosure (right), using a modestly priced 8" speaker.

While I can't describe the results as amazing, the enclosure does sound remarkably good. At the low end, the speaker performed somewhat better than you would expect it to in a bass reflex. There was a slight "boxiness" in the mid-range. Contrary to Gough's stipulation, I put a coiled 24"-by-24" piece of 1" fiber-glass blanket in the chamber behind the speaker. The "boxy" sound was gone.

The thing I liked best was the way the high frequencies were dispersed by reflection from the lid. All tones were nicely blended in any part of the room. So long as you don't expect miracles, you'll probably be quite happy with the Gough enclosure. And you might even join the ranks of his enthusiastic supporters in defiance of my rather lukewarm appraisal.

Welshman—although many experts pooh-pooh it



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13 at the bottom of his class, never reads technical books, and claims ignorance of even Ohm's law. But its hi-fi reproduction and low cost have rocked the audio world in Britain and beyond, despite the fact that no big-time manufacturer has shown interest and some experts have derided it.

Because he wanted "to give ordinary people the truth of music," the quixotic Welshman printed construction plans and copyrighted them. They sell by mail in Great Britain for five shillings (about 70 cents). Americans and Canadians can order the plans for \$1 from Gough & Co., P.O. Box 8102, Long Beach 8, Calif. So far, 9,000 people have been busily working from them.

The sound of music. For a demonstration Gough took me upstairs to a small studio. A turntable, amplifier, and three of his speaker cabinets were spread around the room.

"Only one speaker is connected," he explained as he put on a record. "Close your eyes and tell me which one."

Voices in rich natural tones filled the room. After some hesitation I pointed—at a blank wall!

"Now walk over to the cabinets," he ordered, "and see if you can tell." I cocked an ear over each in turn, finally picked one.

"Wrong!" said Gough, and he pulled off the wires to prove it. Next he turned the volume slowly down to a whisper, and bass and treble dropped in the same proportions.

With the gain back to normal, he led me down a winding hall to another studio. The sound followed us uncannily, and seemed to fill that room as well. At a private demonstration, Gough told me, he'd filled an opera house with a mere 10 watts pumped into an 8-inch unit.

This second studio had an array of expensive commercial speakers with fancy tuned enclosures. In front stood one of Gough's rough plywood boxes. He lowered the pickup onto a spinning disc and organ music roared from Brand X, indicated by a red lamp on the cabinet.

"Cost you 35 pounds (\$100) for that one," he said, grinning. He flicked a switch and Brand Y was in the act. It was tagged at about \$200, and sounded good. "Now listen," he cautioned, and switched over to the humble wooden crate.

"Very little difference," I told him honestly, "but not quite as much bass."

"It's the *true* bass," he insisted, "not the juke-box thunder from a resonating chamber." He then pulled the speaker

[Continued on page 208]



By Ed Mayover
Bradenton, Fla.

My Most Embarrassing Shop Moment

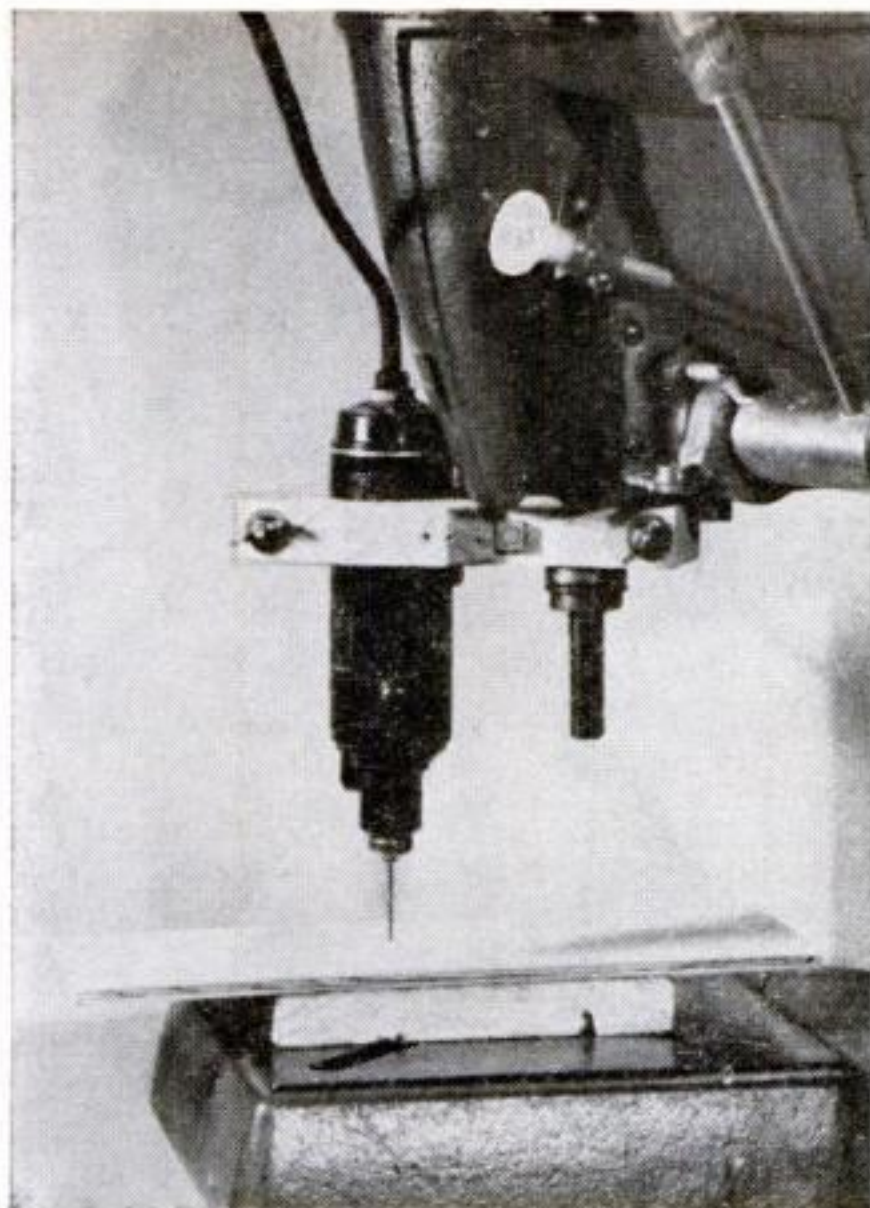
WE HAD just returned from a 300-mile sight-seeing trip with several rolls of highly prized film. My wife wanted me to take the film to the drugstore for processing, but I explained self-confidently that I could do the job much better in my own darkroom where I could give the film my personal touch. A little hurt, I headed for the darkroom.

I turned off the lights, stripped all the rolls, and was just about to put them in the developer when I felt something crawling down my neck. Quick as a flash, without thinking, I snapped on the lights to nail the critter.

I never did find out what it was, but I sure had a mess of ruined film as a result of my game hunt. My wife still ribs me about my "personal touch."

Shop Tips

FROM PS READERS



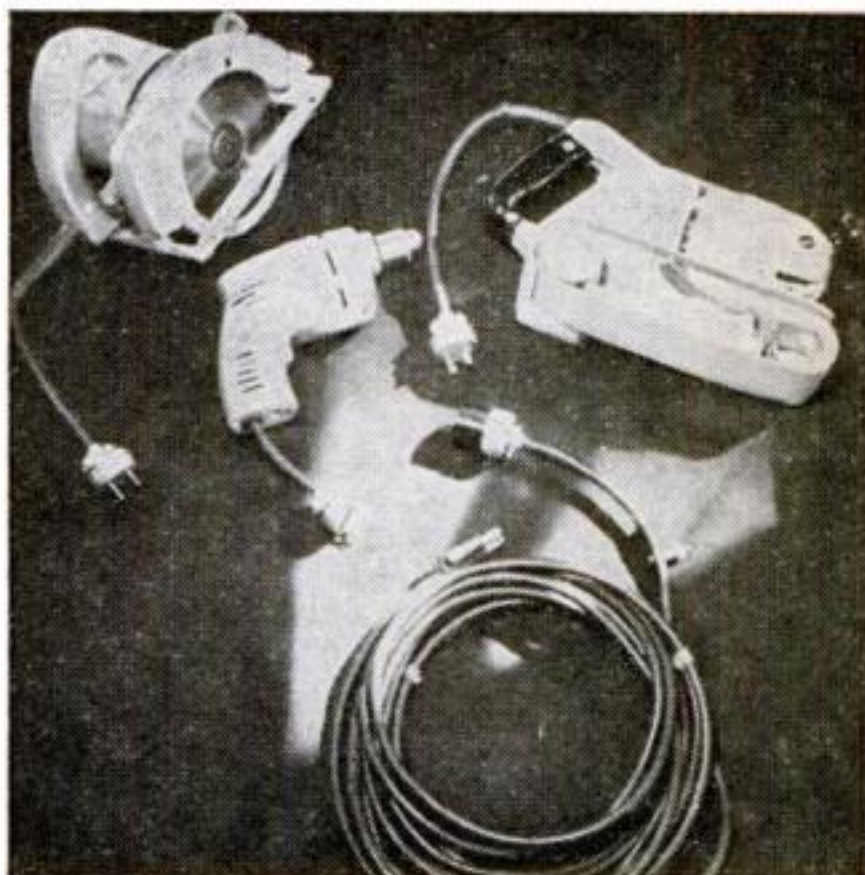
Drill Mounted on Drill

IN ASSEMBLING boxes of $\frac{1}{4}$ " plywood, it's hard to keep brads from splitting out. I use a hand grinder with a high-speed bit for boring lead holes close to the lapped edges. I clamp it to my drill press by means of an oak block. The block has two holes: one for the grinder, the other for the drill-press quill. There's a saw kerf into each hole, to permit tightening with stove bolts and wingnuts. —*W. E. Christnagel, Little Falls, Minn.*

Making Small Hand Screws

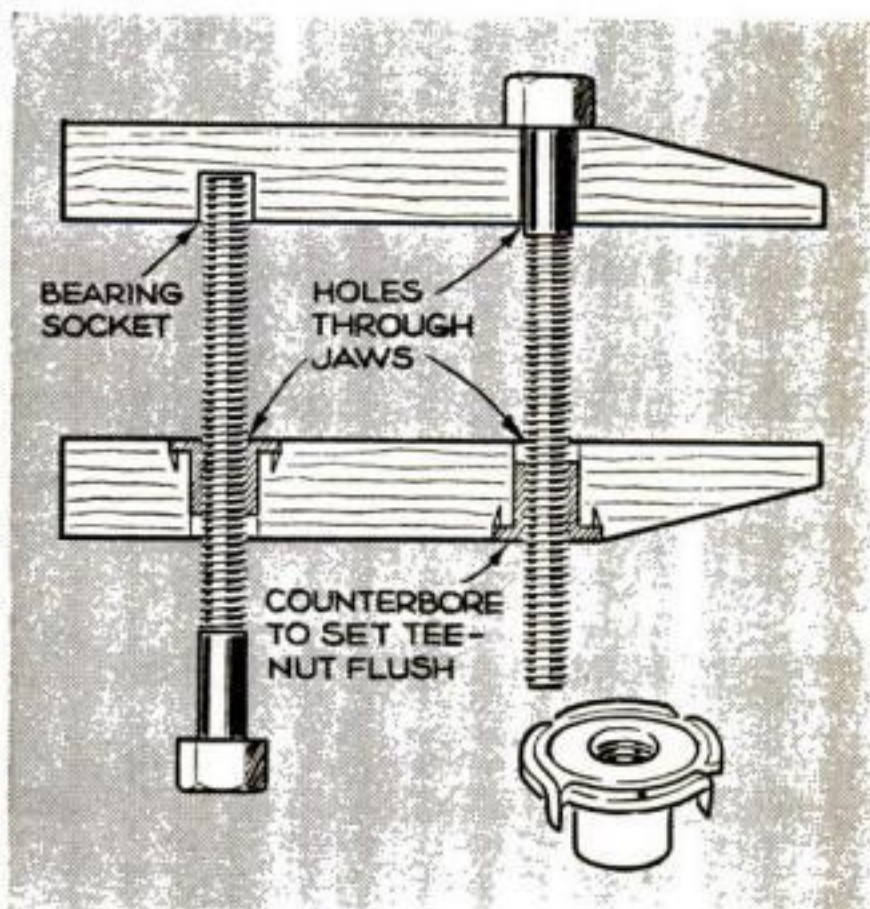
You can make efficient wood clamps from $\frac{3}{4}$ " maple and long bolts. Bore two holes in one jaw to provide a press fit for Teenuts to match the bolt threads. In the other jaw, drill one hole (the size of the bolt shank) through; another, $\frac{3}{8}$ " deep, serves as a bearing socket for the rear bolt. —*Peter Legon, Malden, Mass.*

▶▶▶ WANT to pierce a bottle cork with a neat hole? It'll crumble if you drill it dry. Immerse the cork and weight it down so it soaks through. Then, place the wet cork in the freezing compartment of your refrigerator until it's frozen solid. In this hardened state, the cork can be given a smooth bore with an ordinary twist drill. —*W. C. Wilhite, Carlinville, Ill.*



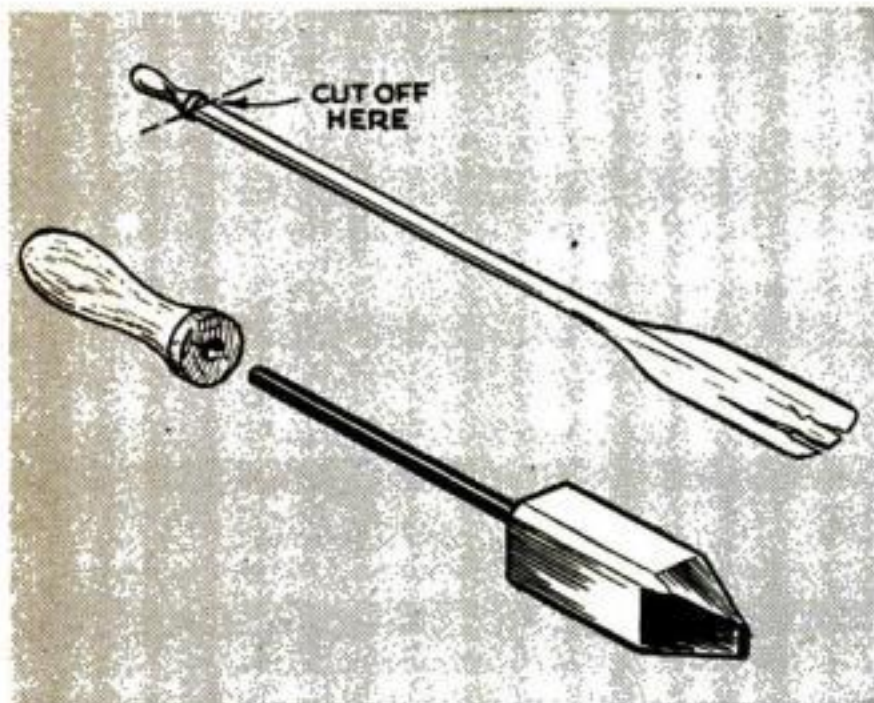
Single Cord for All Tools

PORTABLE power tools, each trailing its own cord, can turn a shop into a snake pit. And there never seem to be enough outlets to keep them all plugged in. To solve the problem, I trimmed off all but a few inches of each cord, and attached twist-lock plugs. Now, one extension cord (with a female socket) serves all the tools. The short cords also make the tools easier to store and carry. —*Dwight A. Williamson, Glen Ellyn, Ill.*



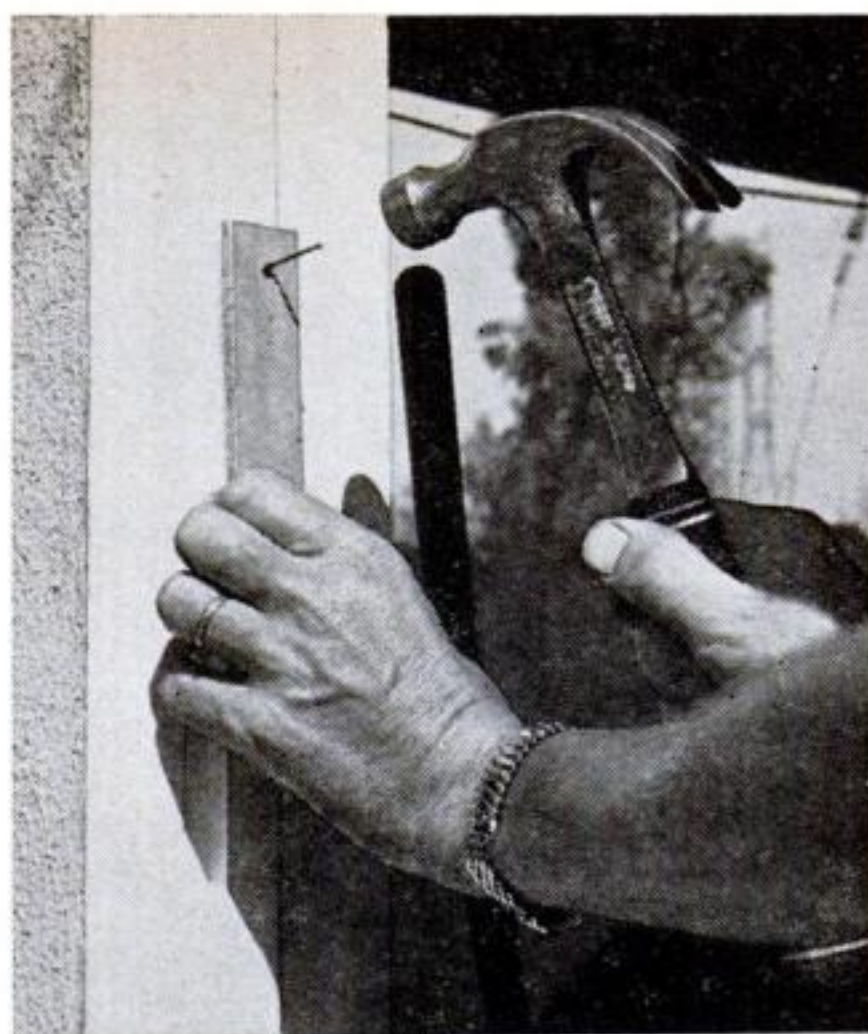
Shop Tips

FROM PS READERS



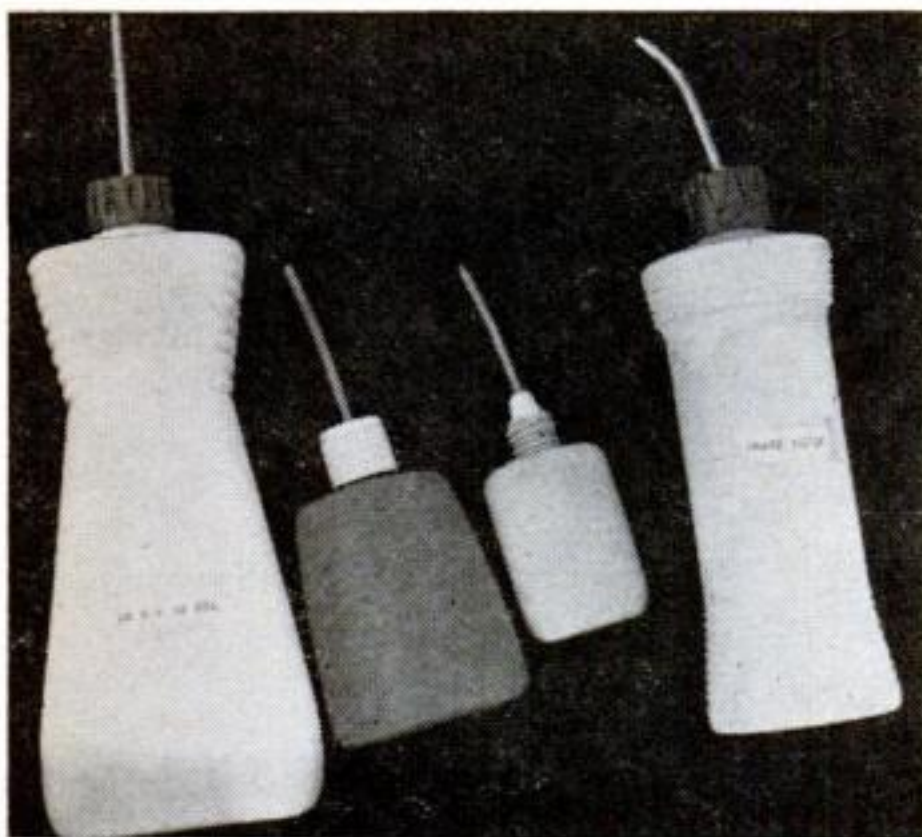
Handle for Soldering Iron

ONE of my most-used tools is a heavy soldering iron. When I had to replace the handle recently, I used the grip from a discarded rowboat oar. The hardwood of the oar is a good heat insulator, and the flaring shape keeps your hand from slipping forward, preventing burns.—*Robert A. Pollock, Staten Island, N.Y.*



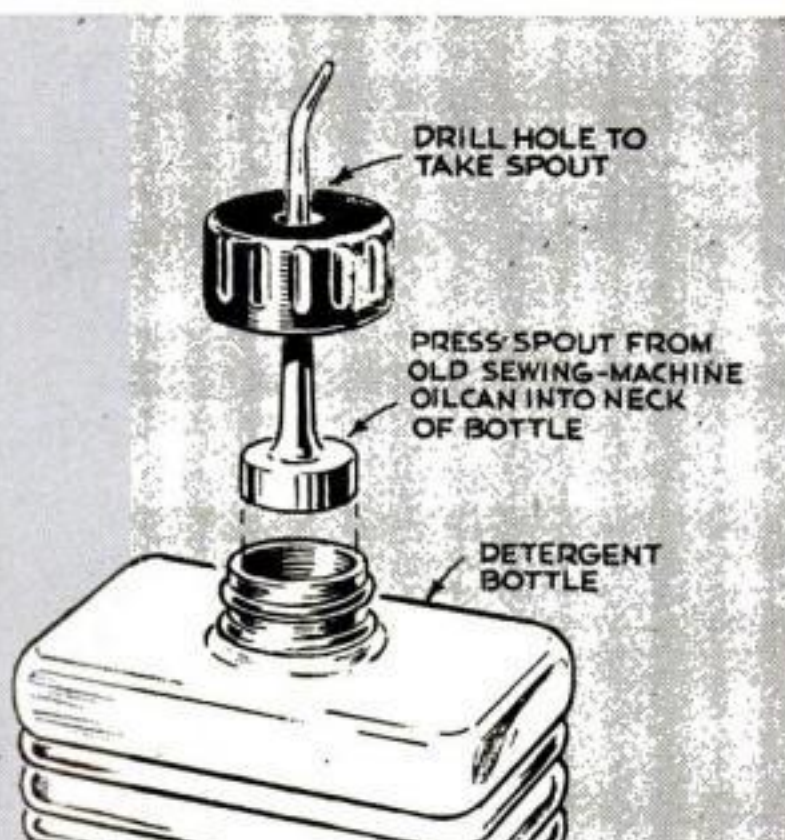
Prevent Hammer Scarring

WHEN driving finishing nails, you can protect the surface with a guard slipped over the nail. Hold a 1½"-by-6" piece of plywood, with a ¼" hole in one end, over the nail during the initial hammer blows. Then remove the guard so the job can be finished with a nail set.—*E. M. Harman, North Hollywood, Calif.*

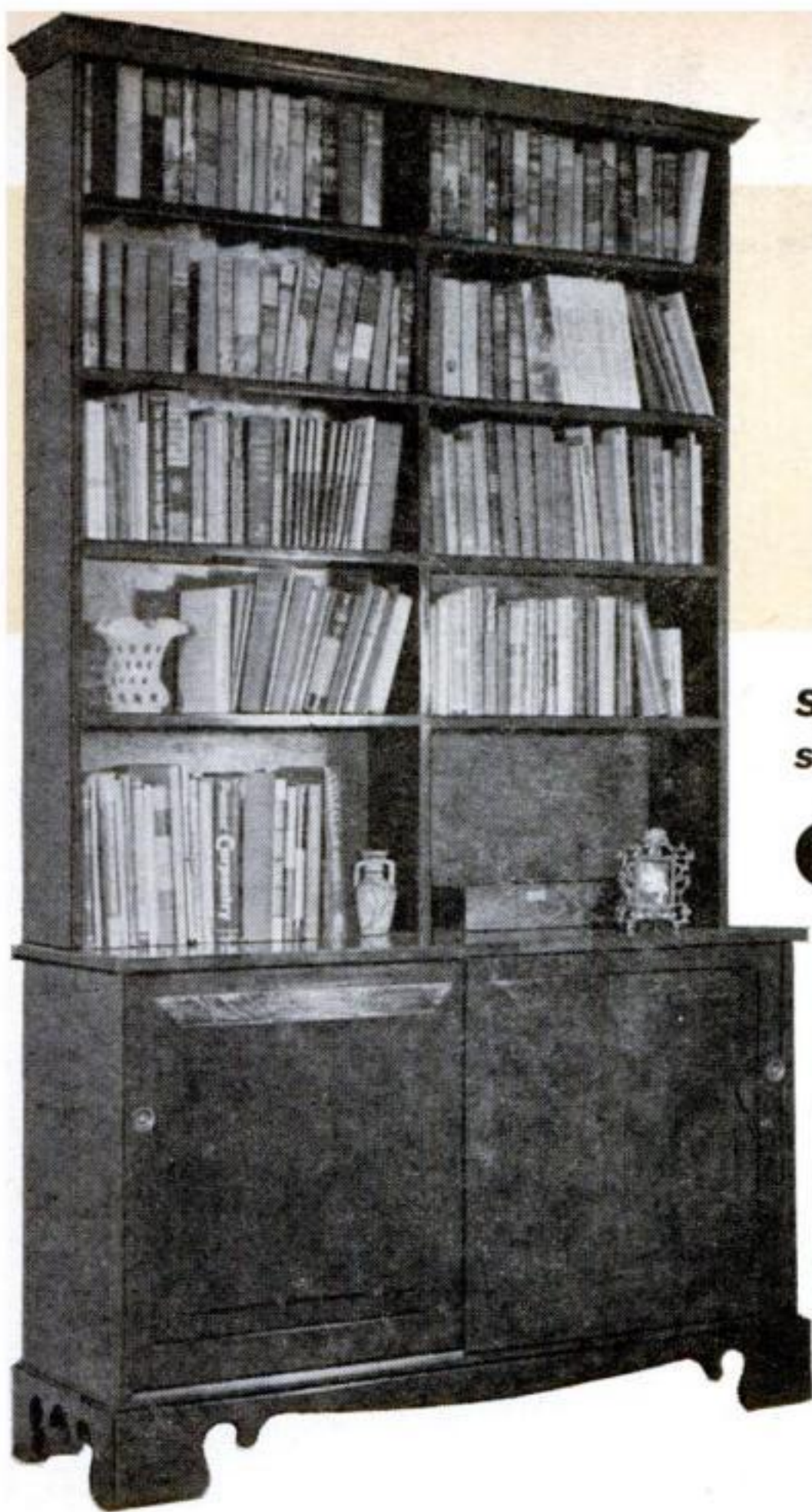


Oilcans from Plastic Bottles

LIKE a selection of oilcans? Try using plastic containers of various sizes, from big squeeze bottles to little atomizers. The large bottle at left, equipped as shown in the sketch, squirts with the force of a pump oiler. For the bottle at



right, I just pressed a metal tube into an undersized hole in the cap. With the spray bottles (center), I removed the nozzles and tubes to drill a hole for the tube at the nozzle tip. These small tubes measure out a drop or two at a time to provide precise and thrifty oiling.—*F. L. Smith, Kenmore, N.Y.*



PS Winter Workshop PROJECTS

14 PAGES

*Simplified cabinetmaking
speeds construction of this—*

Colonial- Style Book Hutch

By Alvaro A. Altomare

FEW craftsmen who fancy Early American design would try to reproduce it using only the woodworking tools of that era. Power tools have brought speed and accuracy to the modern shop. Still, you needn't own a basementful of them to turn out ambitious pieces with a period flavor, like this bookcase cabinet. Though I used a router and a jigsaw, all you really need is a table saw—and some tricks of the trade.

More important than tools in planning such a project is the lumber. Ponderosa pine is ideal here because most lumberyards can supply one-inch boards (actual thickness: $\frac{3}{4}$ ") wide enough for you to

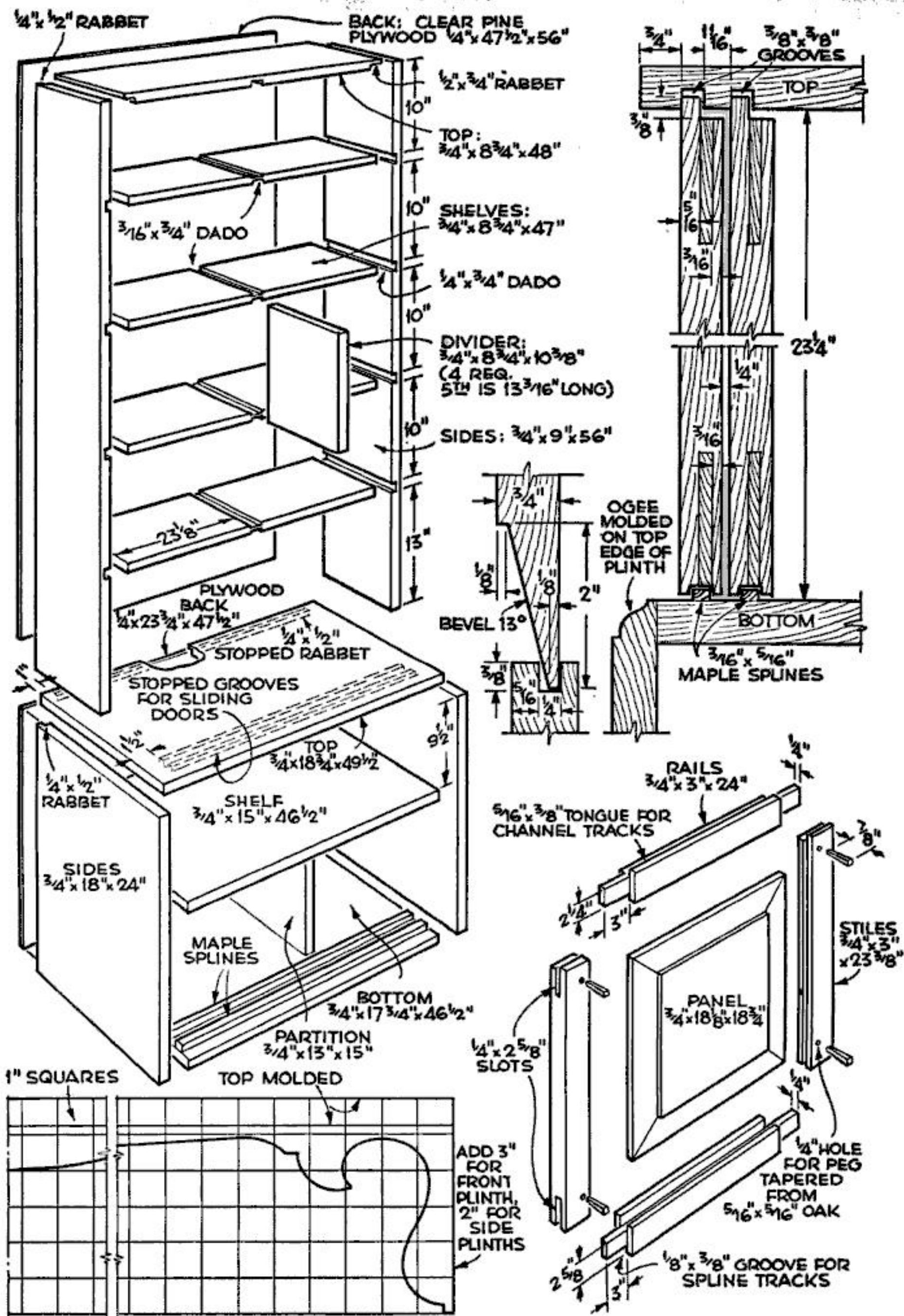
make the base cabinet just as the Colonial cabinetmaker did—without gluing up panels. Clear lumber isn't necessary; in fact, small, sound knots enhance the Early American character.

Two-piece construction. The shelf unit sits atop the cabinet without being joined to it. This makes both sections easier to build—and to move, in case your wife's a confirmed furniture-shifter. If you prefer, you can anchor the bookcase to the wall with a couple of screws through the back panel, near the top.

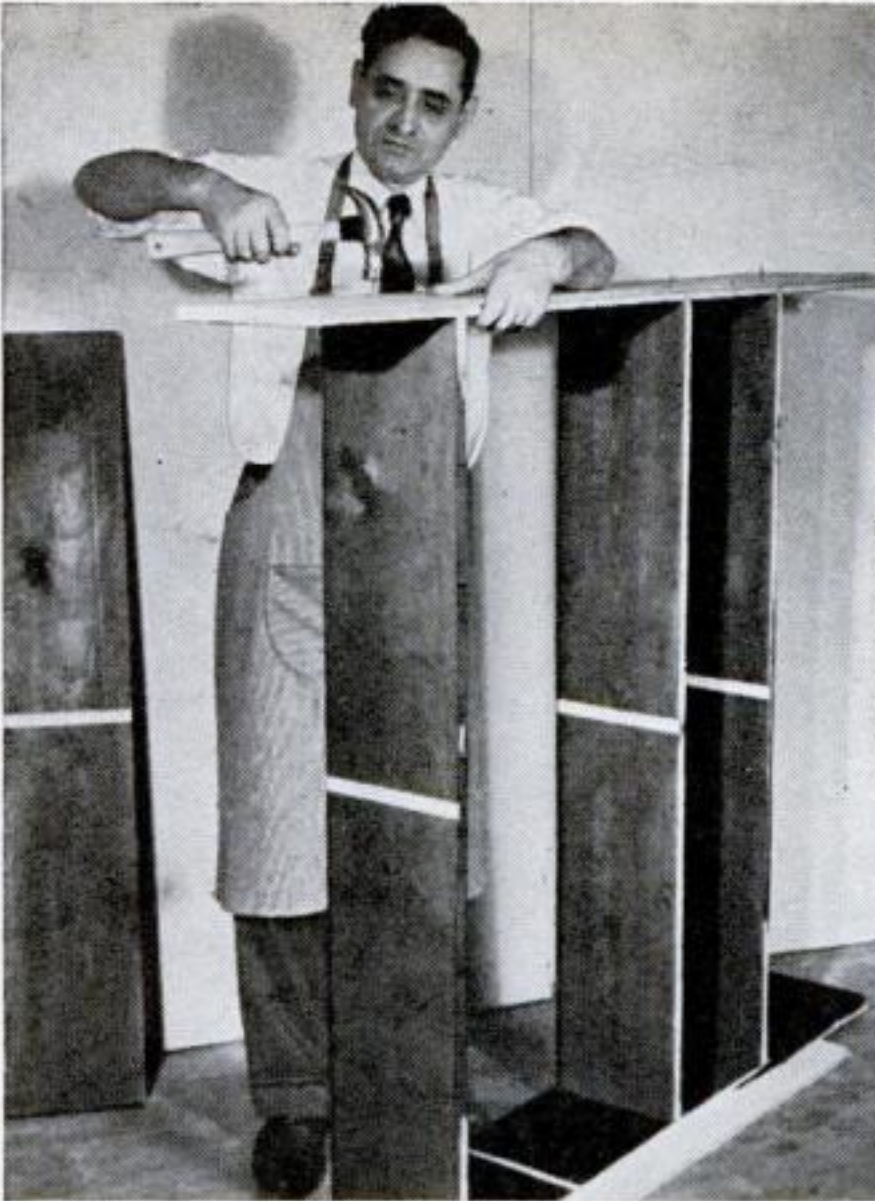
In building the cabinet, you can use plywood for the bottom and the shelf, as well as for the back panel. Except for

CONTINUED

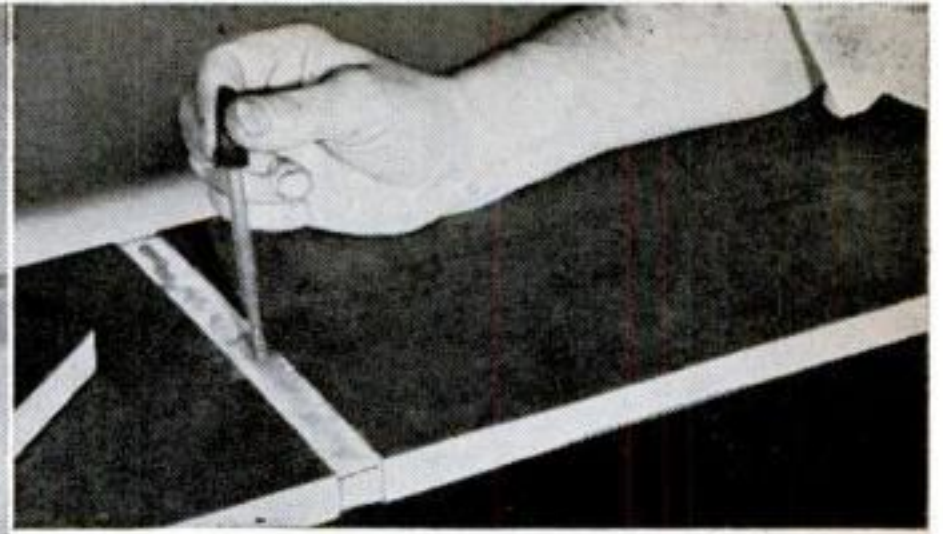
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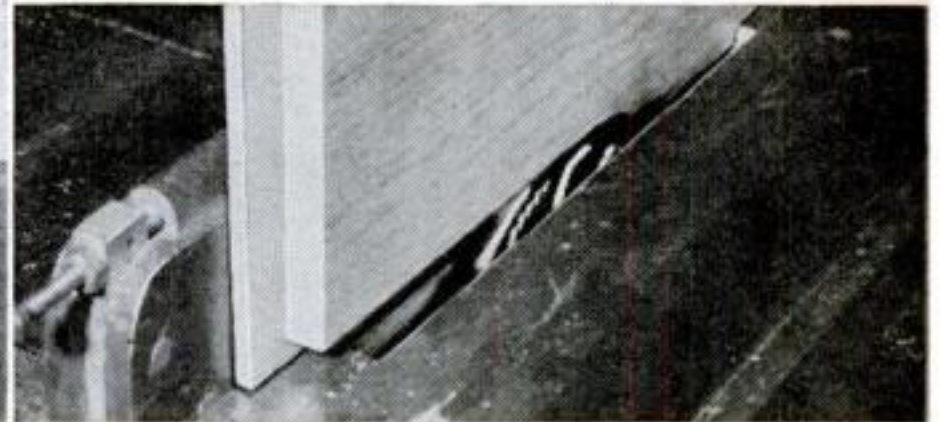
Professional short cuts make bookshelves easier to build



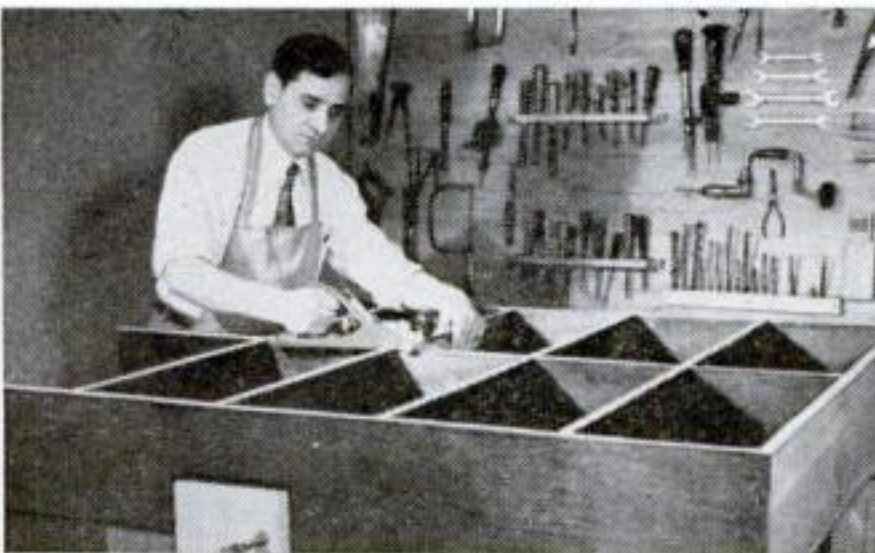
STAIN BEFORE ASSEMBLY for even, "into-all-corners" coverage. It's quicker and simpler to work with flat pieces, where stain may be wiped right up to edges, ends, and joints. Surfaces to be glued, of course, aren't stained.



APPLY GLUE LIBERALLY to partition dados. This assures strong joints, even without toenailing. Wipe excess glue away with a damp cloth; without prestaining, such wiping could seal pores, so stain would "take" spottily.



RABBETS ARE CUT IN ONE PASS on a bench saw equipped with a dado head. A regular, single blade would require two passes and frequent readjustment. Rabbits permit use of shorter, thinner nails, reduce danger of splitting.



PLANE FRONT EDGES EVEN; discrepancies in board widths must be confined to the front, since rear edges of shelves, top, and partitions must be flush with the rabbet cut in the sides. Planed front edges will require restaining.



FINAL FINISHING of shelf unit is done much more quickly before back panel is attached. With free access from both sides, varnish or shellac "runs" can be brushed out easily. Finish back separately before it's applied.

rabbets in the sides and top (to take the back), this unit is assembled with butt joints. The bottom is set in front of the back panel and between the sides.

The sliding doors are a little harder to make. All frame parts are $\frac{3}{4}$ "-by-3" stock, and the corners are slip-jointed. Lay out the tenons (and the slots to receive them) after cutting the grooves for

the fielded (raised-center) panel. Don't drive the pegs flush; a $\frac{1}{8}$ " projection adds a decorative touch. The grooving and rabbeting to fit the sliding track may be done before or after assembly.

The top edge of the three plinth pieces is molded to a common ogee shape. This operation, too, can be done on the bench saw, using a molding head, if a shaper



PREFINISH INSIDE SURFACE of back panels before setting them into side rabbets and fastening with 1" flathead nails. If you can find a full-size, attractively grained panel, application can be in one piece instead of two shown here.



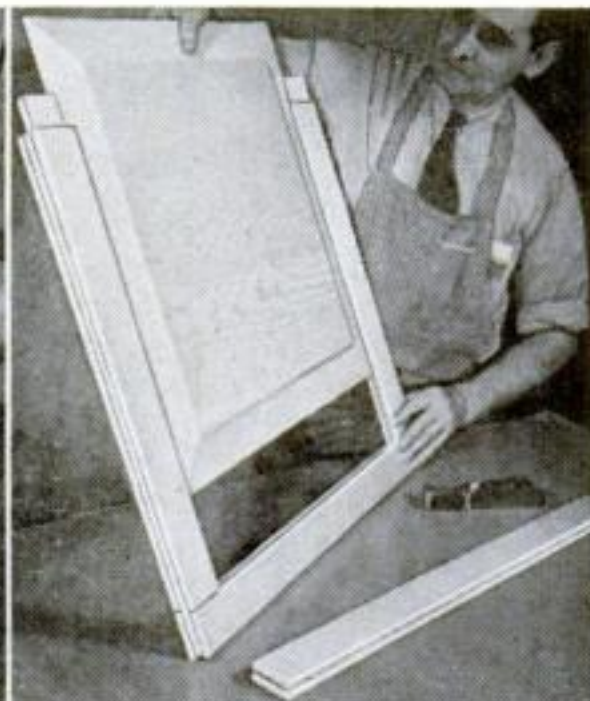
TRIAL-FIT CROWN MOLDING before attaching it as the final step in the bookcase assembly. Accurate miters are important. If preferred, the three pieces may be finished to match the shelf unit before they are nailed in place.



CHANNELS IN BOTTOM FACE of buffet top save cost of hardware tracks for sliding doors. If you have no router, these stopped grooves may be cut on the bench saw, finished with a chisel. Top will project $\frac{3}{4}$ " at each end of case.



CUT FIELDED PANELS on bench saw with only two passes per bevel. First, establish perimeter of raised center with four shallow face cuts. Then raise blade and tilt it 13 degrees to slice into face cuts. Planing removes sworls.



SLIDE PANEL INTO GROOVES in the rails and stiles. Then slip final stile (foreground) onto rail tenons. As sketches on a previous page show, dimensions of slip joints, panel grooves, and track flanges are correlated to simplify cutting.



TIP DOORS INTO PLACE by inserting tongue on upper rail into groove beneath chest top (left). Then swing groove in lower rail over spline tacked to chest bottom. Gravity holds door in place. Wax grooves and splines to lubricate.

RUN PLINTH BLANK through shaper to mold the upper edge before scroll design is cut. Though this is contrary to usual practice, it would be awkward and dangerous to pass the narrow section of the finished piece past the cutter.



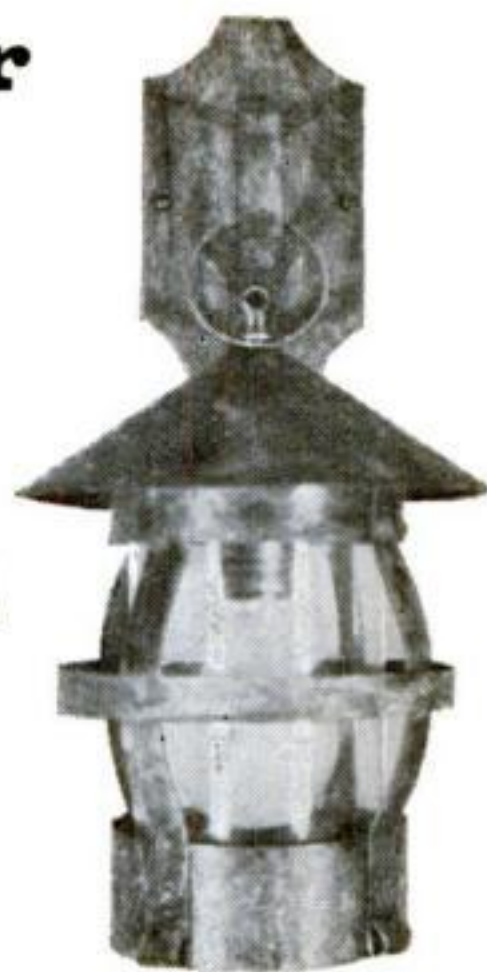
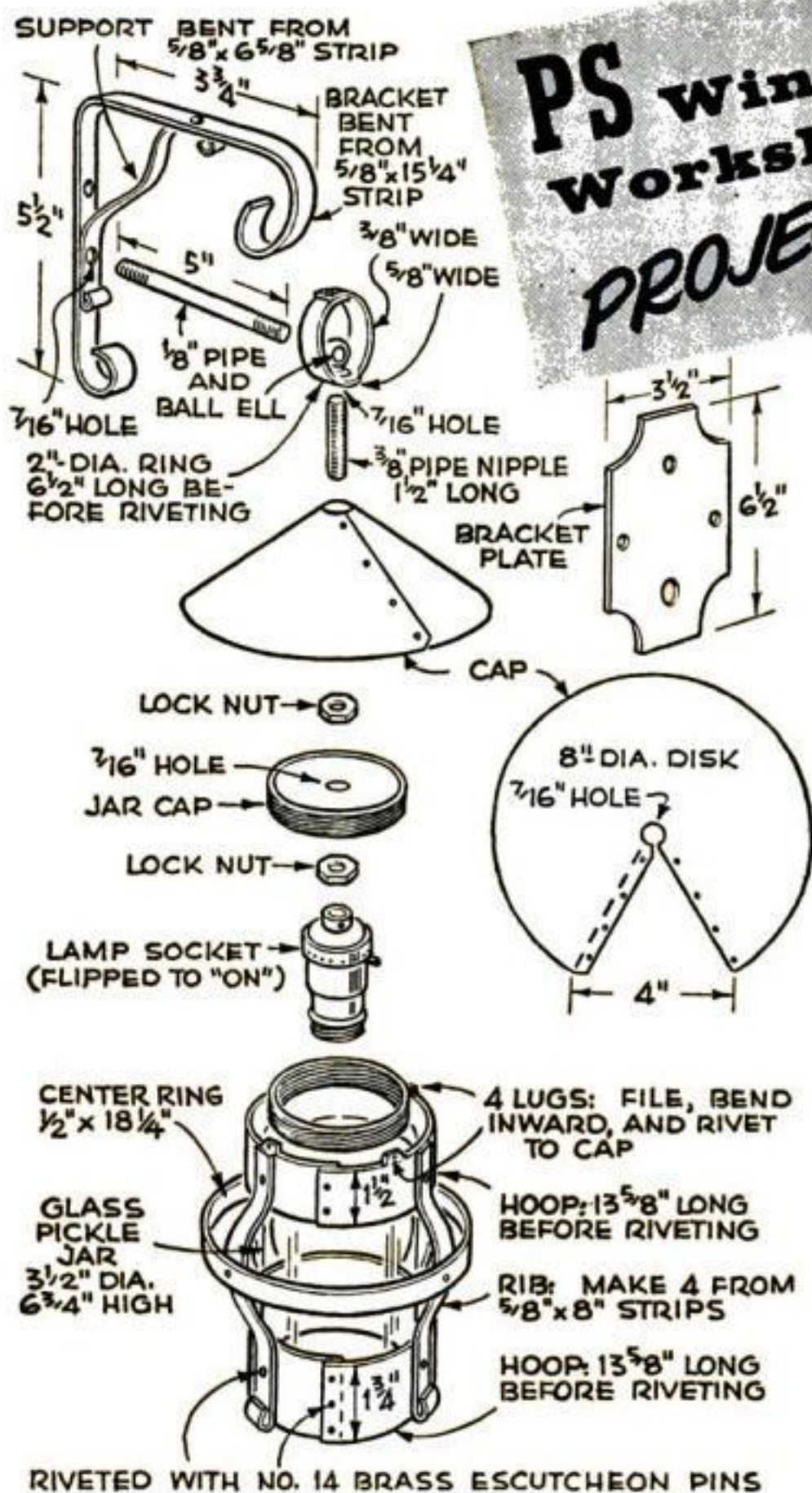
or router is not available. If you don't own a jigsaw, cut the scroll design with a coping or compass saw. Miter the butting ends and fasten the plinth in place with 3" 10-penny finishing nails.

The bookshelf unit. This is assembled with dado joints. The four shelves are identical; their center dados can all be cut with one setting of the saw fence. Use $2\frac{1}{2}$ " eight-penny nails to fasten the

sides to the shelves. Set the heads and fill the holes with wood putty tinted with the same stain applied to the wood.

Whether stained before or after assembly, each piece must be thoroughly sanded, using 6/0 garnet paper for the final cut. Dust well and apply an antique brown oil stain, followed by varnish, or four or five coats of cut shellac (two parts alcohol to one part shellac). ■ ■

A Hammered-Copper Porch Lantern



THE globe for this hammered-copper lantern is a pickle jar. For the hammered-metal parts, work over a sheet of 18-gauge soft copper with the round end of a ball-peen hammer. Do this before cutting; hammering after cutting may distort the pieces.

Rivet the hoops and ribs together with No. 14 brass escutcheon pins to assemble the lamp house. Cut out the cap and rivet it to form the cone shape; then rivet it to the lugs formed on the upper hoop of the housing.

Using standard lamp hardware— $\frac{1}{8}$ " pipe nipple and ball ell, a socket and two $\frac{1}{8}$ " pipe-thread hex nuts—fasten the jar lid under the lantern cap. Lock the hanger ring on top of the cap by tightening the ball ell on the nipple.

A decorative bracket to hang the lamp on can be made from two strips of 16-gauge or heavier copper.

Left unfinished, the copper will weather to a soft green.—*Dick Hutchinson, San Gabriel, Calif.*





Slide the tambour back...



... lower the side flaps



... and pull up a chair

Roll-Top Typing Desk

GRANDPA'S roll-top desk inspired this compact typewriter stand. It will hold a portable or standard model, protecting it from dust yet keeping it ready for service as soon as you slide back the tambour. The stand then spreads its wings into an ample desk, with space for copy and typing paper.

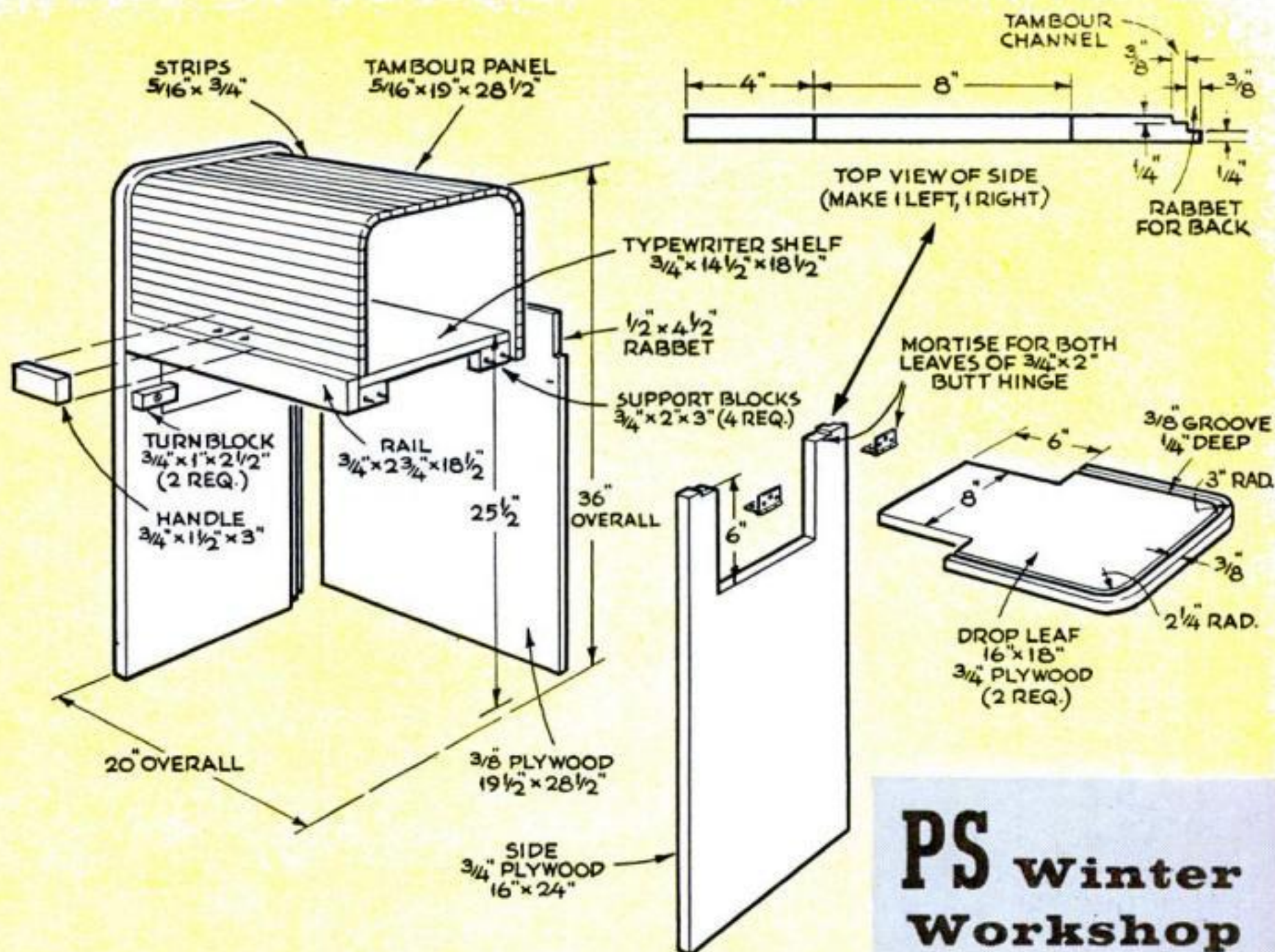
Make the tambour first. It's a flexible panel: slats cut into equal lengths and glued to a cloth backing. I used screen-door molding and blue denim. Light canvas or duck can be substituted; so can vinyl-coated upholstery cloth, but glue the strips to the cloth side. Prefinish the strips before gluing.

Use contact cement, such as Weldwood or Pliobond. Coat the cloth just far enough ahead so that it will be tacky as you press each individually coated

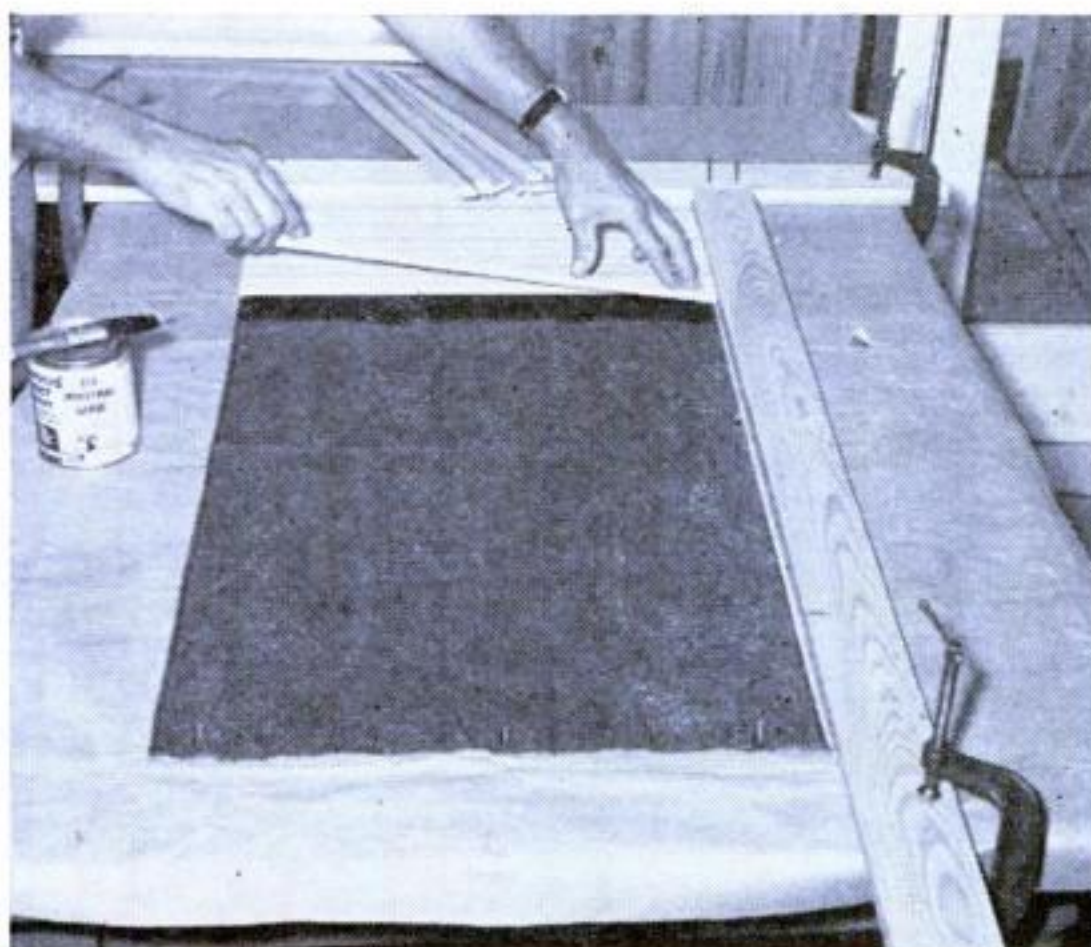
slat in place. As you work, check with a carpenter's square against the side cleat to keep the slats parallel throughout. After the cement dries, trim each end of the cloth flush and tack it along its two outside strips for extra strength.

The tambour channel around each leaf is best cut with a $\frac{3}{8}$ " router bit in a portable router or the drill press. Bandsaw a working template of the curve and tack it to the face of the leaf.

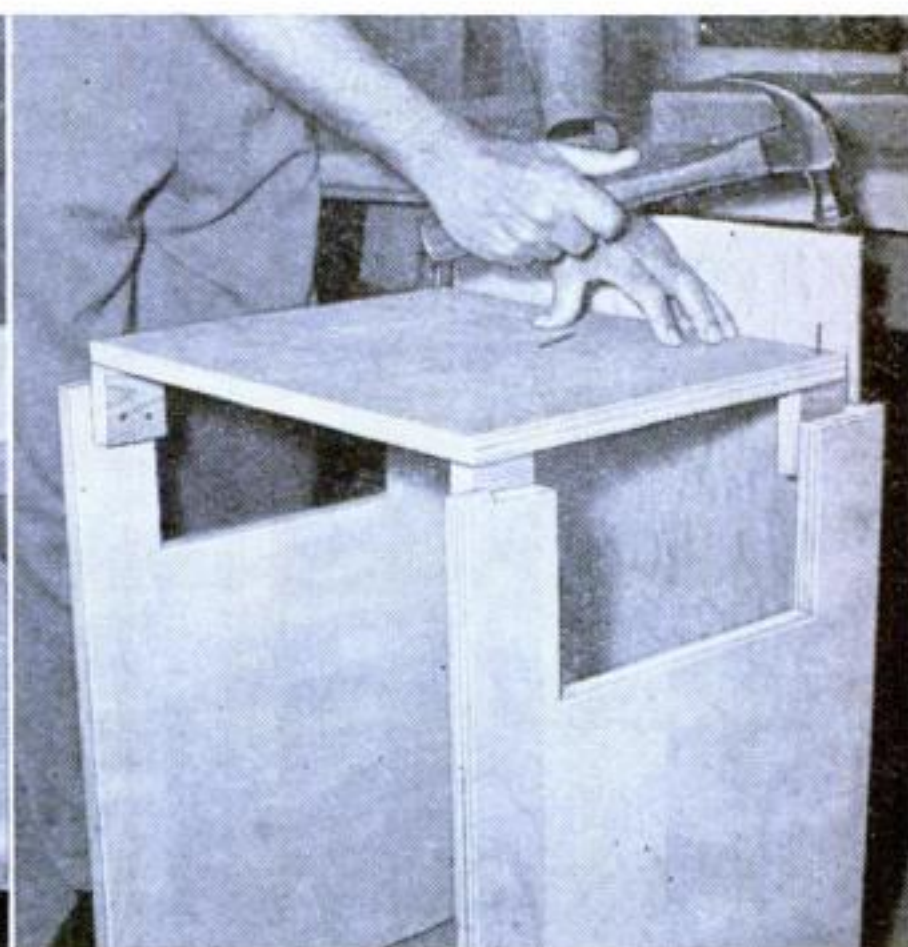
The fold-down leaves. These are unusually sturdy; the secret's in the hinging. Each leaf is supported, cantilever style, by the typewriter shelf. Screw the hinges to the leaves first, insert the leaves beneath the shelf, and secure the other half of the hinge in the mortise cut in the top edge of the sides.—*Keith Vining, New Smyrna Beach, Fla.*



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TO MAKE THE TAMBOUR, fasten one end of cloth under cleat and tack other end taut. Clamp second cleat along edge, at right angle to first. Brush cement on several inches of cloth and a few strips of molding (prefinished) at a time.



ASSEMBLE STAND with butt joints. Blocks to support typing shelf are first screwed to sides, projecting $\frac{3}{4}$ " above top edge, and sides are joined to the back. Typing shelf is then nailed to blocks, as shown. Front rail completes base.

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Turned Tray with Turned Handles



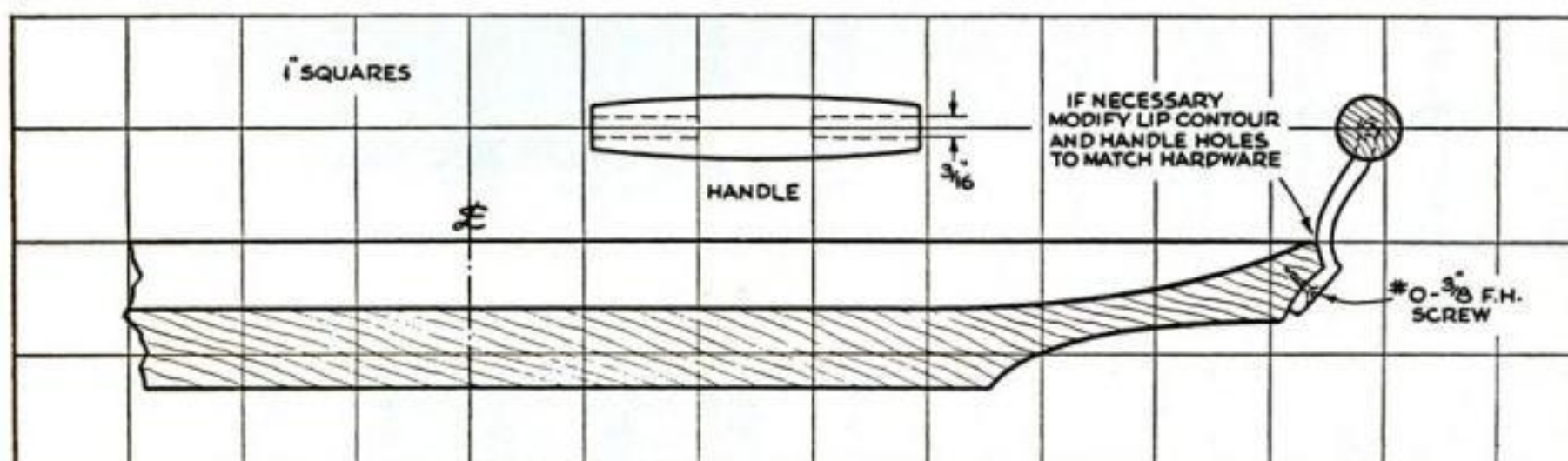
HANDLES that match the tray and are attached with special hardware add simple elegance to this lathe project.

Choose a straight-grained board about $1\frac{1}{2}$ " thick, and rough out the circumference on a jigsaw or bandsaw. The diameter of this turning disk should be $\frac{1}{2}$ " larger than that of the finished tray.

After turning, sand smooth, fill the pores with paste wood filler (if the wood

is open-grained), and apply varnish, lacquer, or an oil finish. Turn the handle grips from the corner scraps, and finish them to match.

If the metal brackets shown aren't available locally, you can order a set from Bustad's Myrtlewood Factory, 1240 South Holladay Drive, Seaside, Ore., for \$1 (postpaid anywhere in the U.S.A.)—*E. Milton Grassell, Corvallis, Ore.*



USING A ROUND-NOSE CHISEL, scoop out the top recess after the bottom contours are shaped.

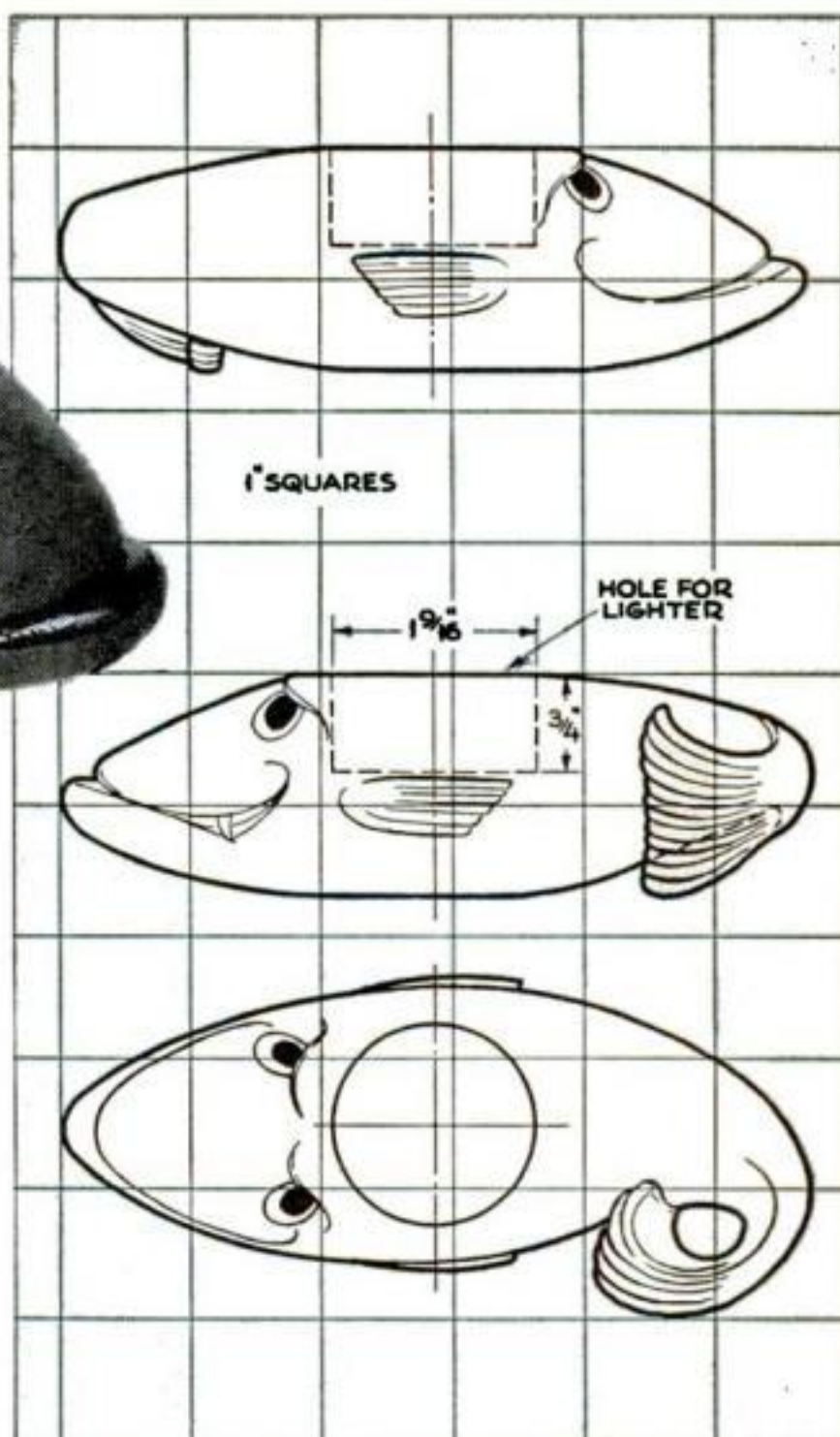


BRACKETS ARE ATTACHED with screws. Hold assembled handle in place to mark screw holes.



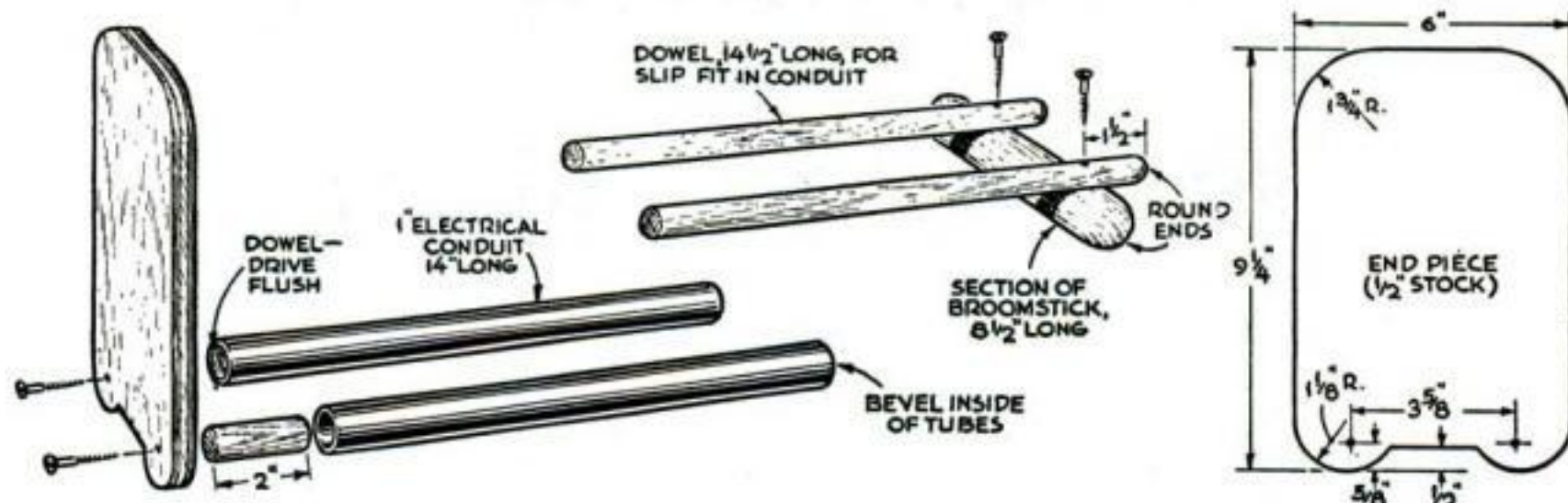
Carved Lighter Base

GUESTS will never forget to replace your table lighter while this persuasive pike keeps his eye on them. The lighter lifts out of a brass ferrule recessed into his back. Transfer the enlarged pattern to a carving block (I used teak). Drill the ferrule hole, and saw around top and side outlines, leaving a 1"-square projection at the tail to clamp in the vise while carving the body to shape. Paint on eyes and mouth, but leave the rest natural.—*John Killebrew, Madison, Wis.*



Expanding Book Rack

AN INCLINE keeps books standing neatly on this adjustable rack. And if you need room for more books, just slide the dowel section out to provide extra length. Fully extended, the rack will nearly double the number of books it can hold.—*Ken Patterson, Moose Jaw, Sask.*

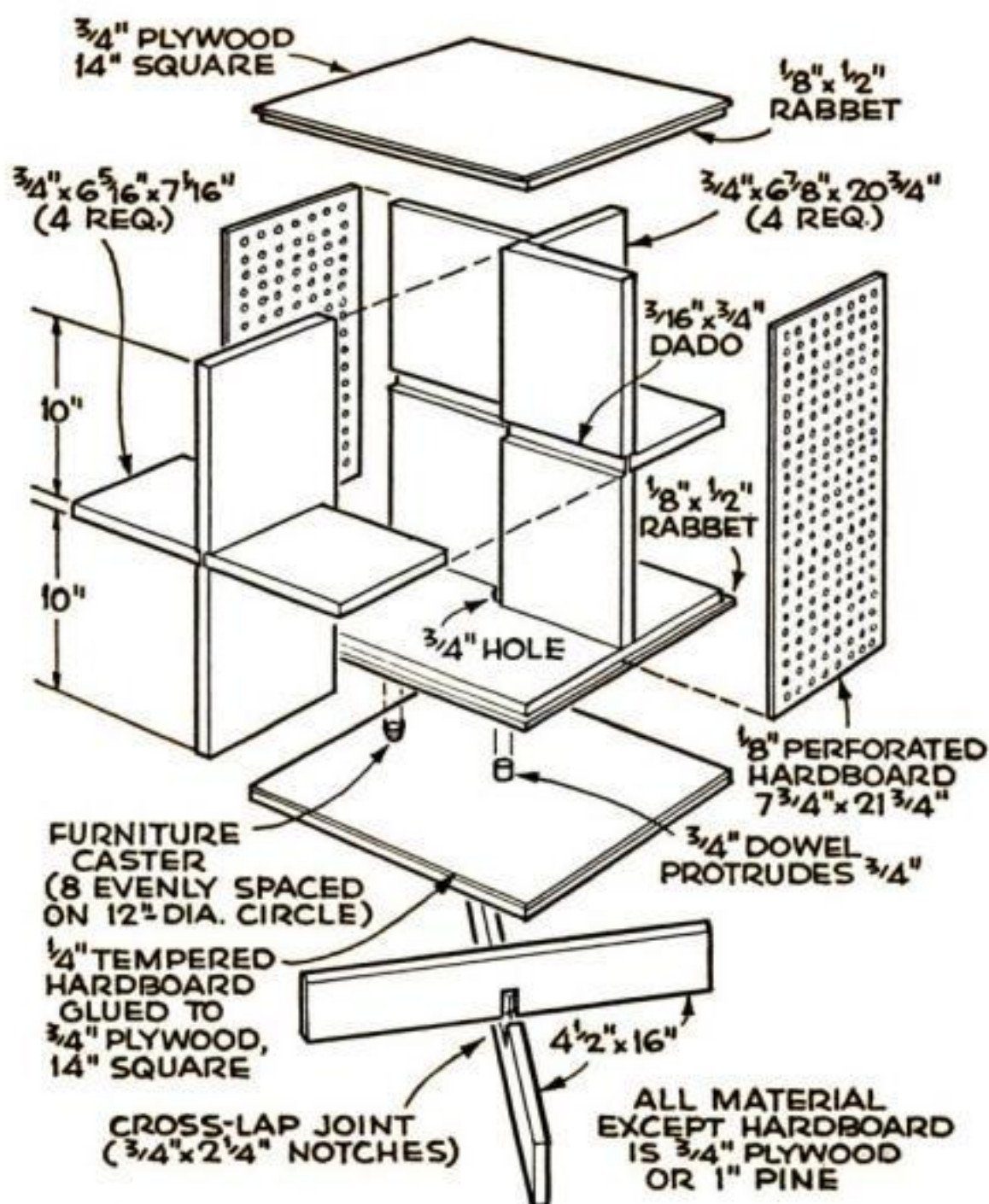




Revolving Bookcase

TOO often, books are wall-flowers—thrust into the background and forgotten. Here's a unique bookcase that brings a generous selection of books out into the room, within reach of your easy chair or desk. The compact, four-compartment case rotates on its base, riding on eight furniture rollers and a pivot peg.

Start with the case. Construction is simplified by the fact that the four up-rights are identical, as are the four small shelves that slip into their dados. The top and bottom differ only in that



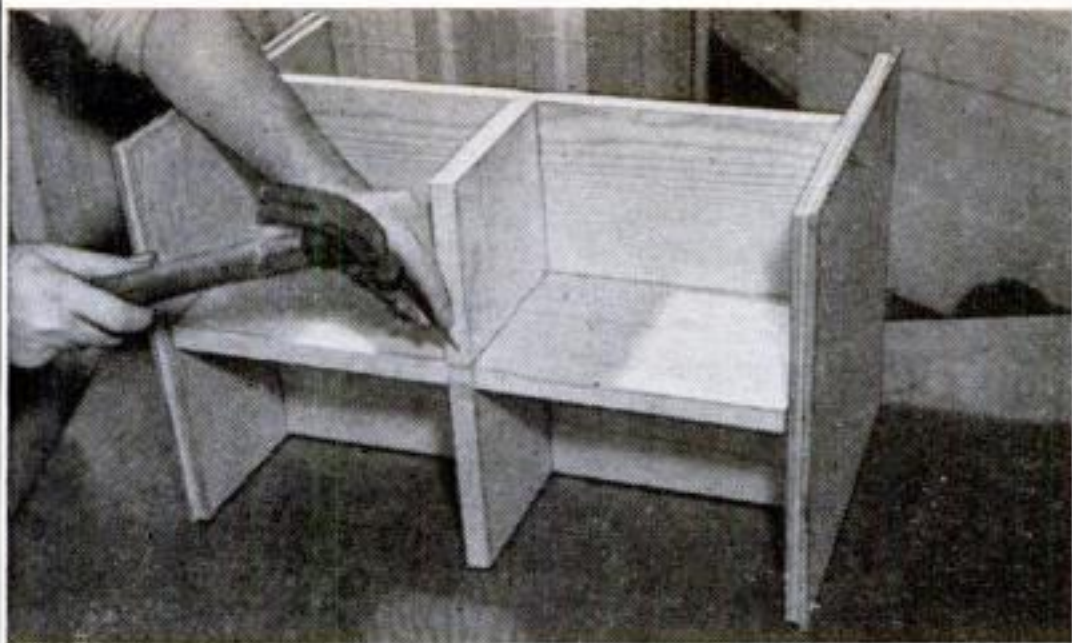
the latter has a hole through the center to take the pivot peg, and eight sockets bored in its lower face for the ball-bearing rollers. Both top and bottom are rabbeted to take perforated panels, attached with glue and small brads.

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Bathroom Rack

SHALLOW medicine chests seldom provide enough storage for jars and bottles, and offer none for bulky bathroom supplies. Fit this self-supporting shelf to the top of a toilet tank, and you gain a rack for guest towels, too. —Gene Handsaker, Redondo Beach, Calif.



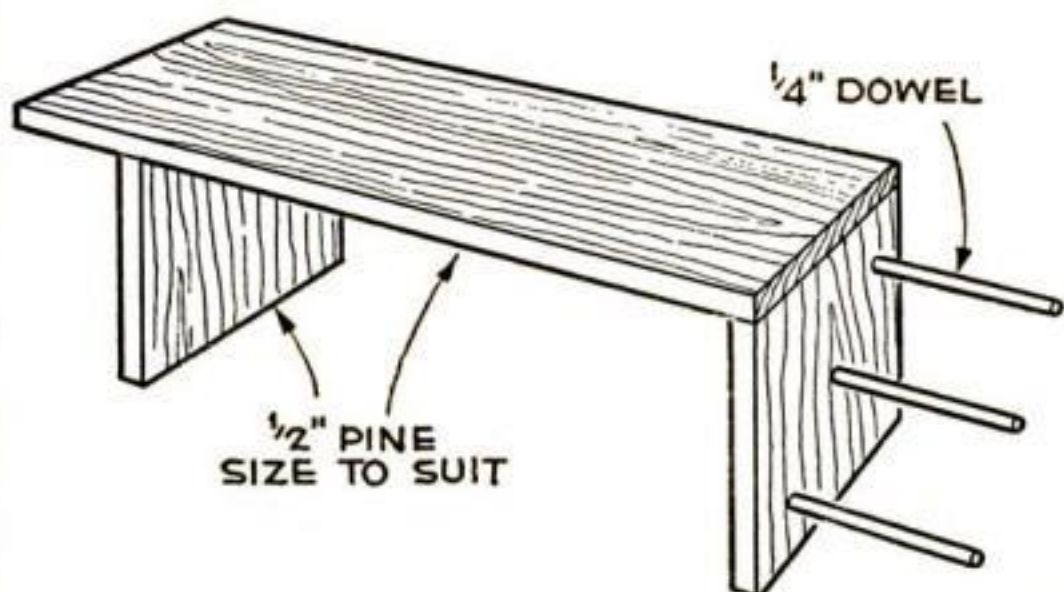


SLIP SHELVES INTO DADOES after top and bottom are attached. Secure with glue and finishing nails. Half of the nailing can be done through the dados, the other half by toenailing.

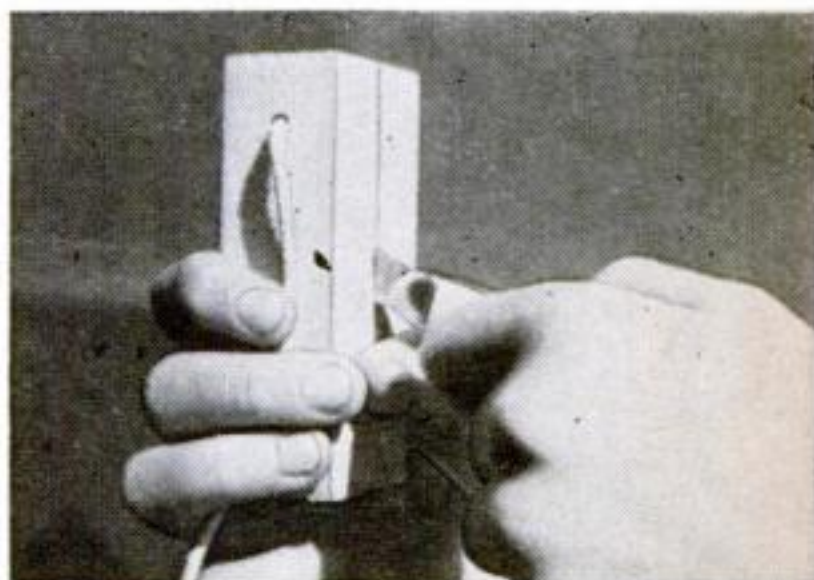
BALL-BEARING ROLLERS are recessed in wells drilled part way through bottom of case. Diameter of hole is determined by size of caster. Depth should let each caster protrude $\frac{1}{8}$ ".



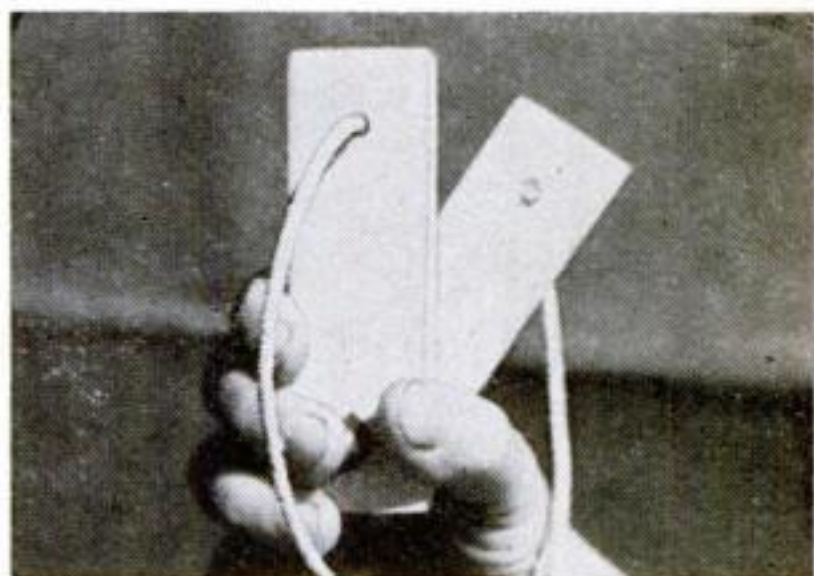
Glue and nail the pivot peg into the base platform, and apply the hardboard facing, slick side up. After painting both sections, lift the case onto the base and drop it down over the peg.—*Philip Bonn, Arlington, Va.*



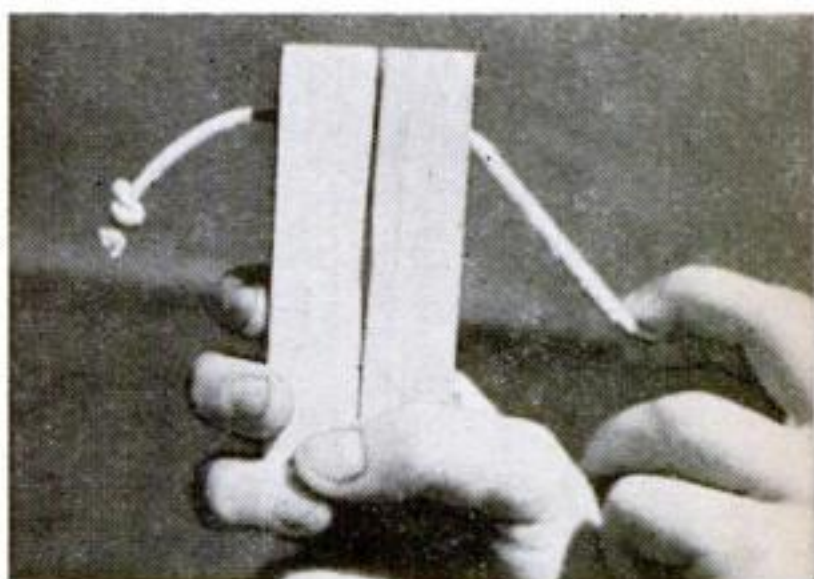
A Trick the Witches Made



THE CORD IS CUT where it threads through a pair of wooden blocks bolted together.

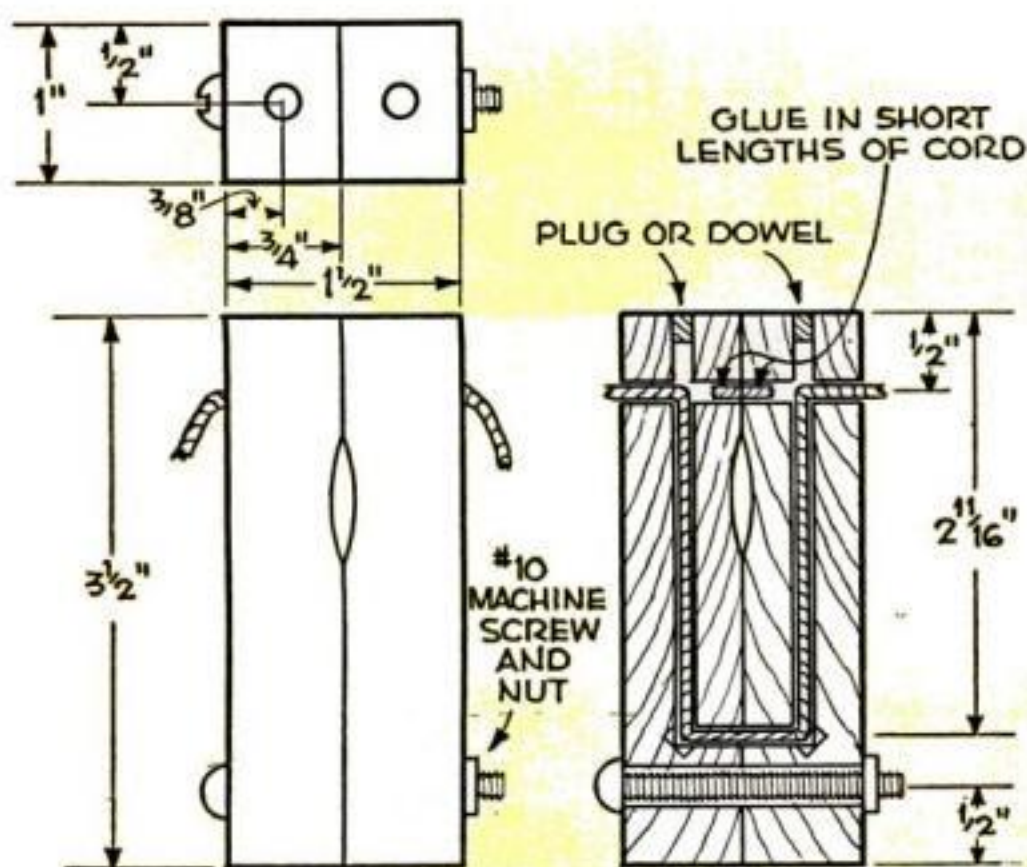


BLOCKS PIVOT to reveal severed ends of cord, are flipped shut as spell is said.



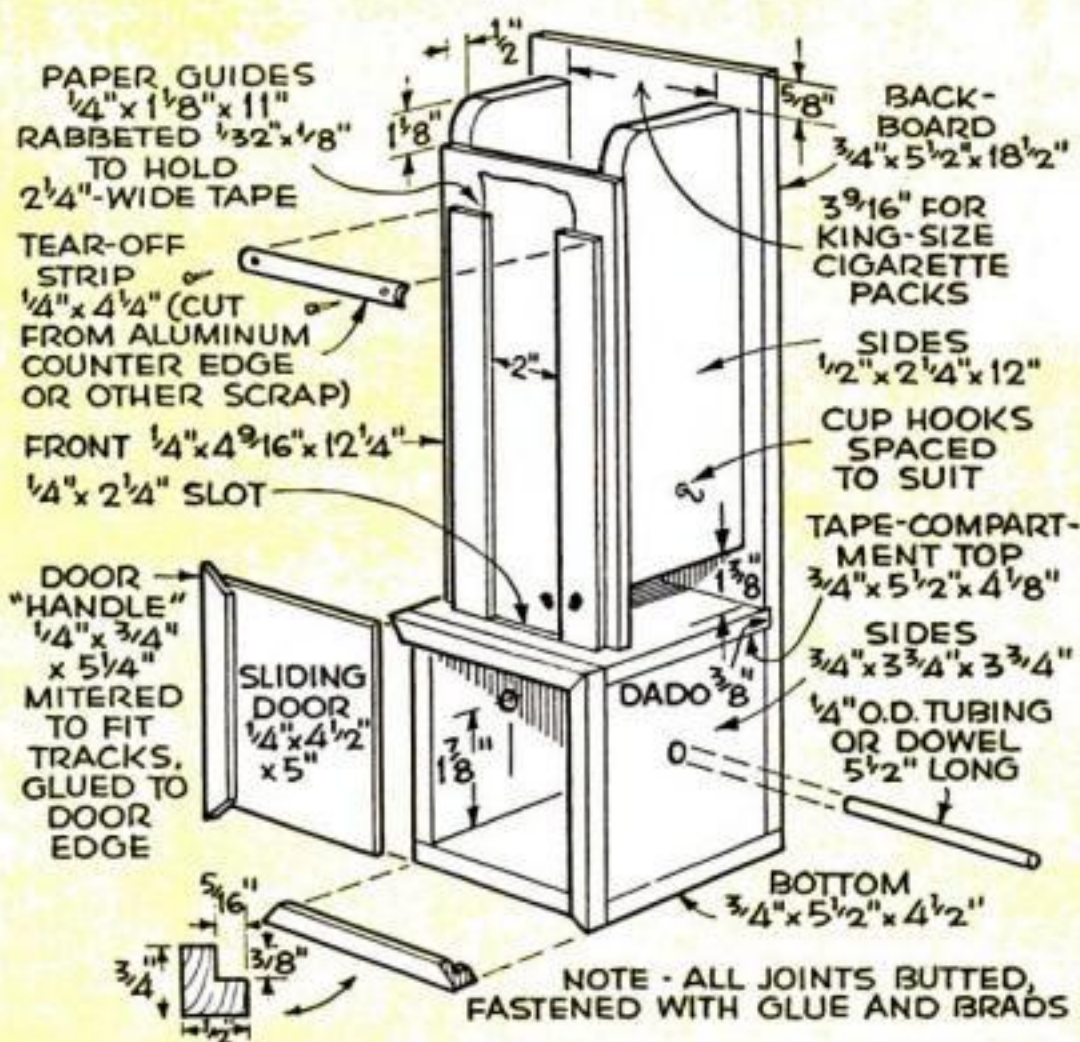
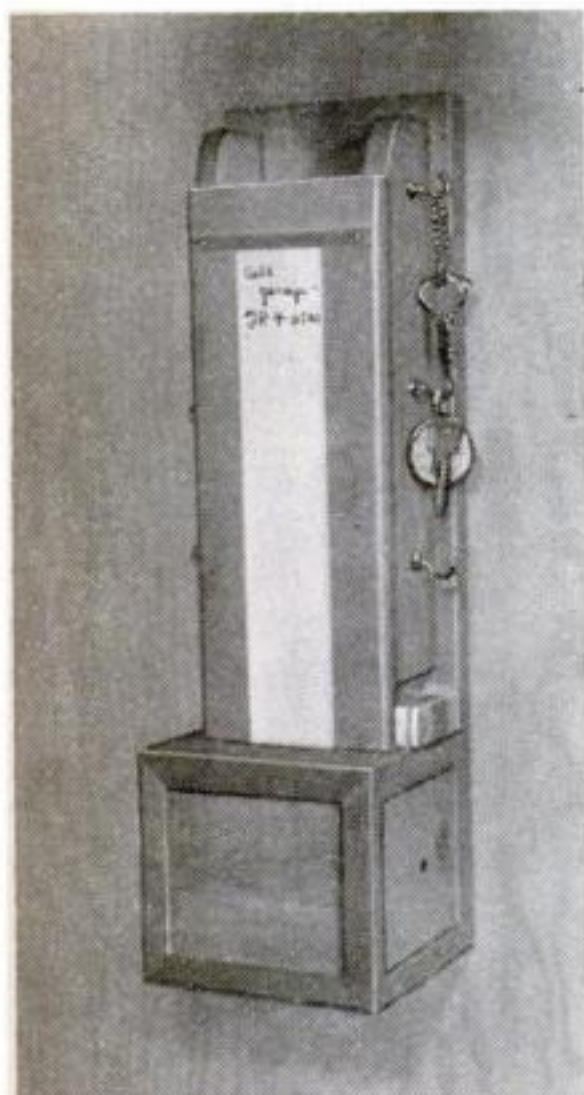
MAGICALLY MADE WHOLE again, the cord can now be pulled back and forth in the holes.

How can YOU do the trick, too? Turn the page



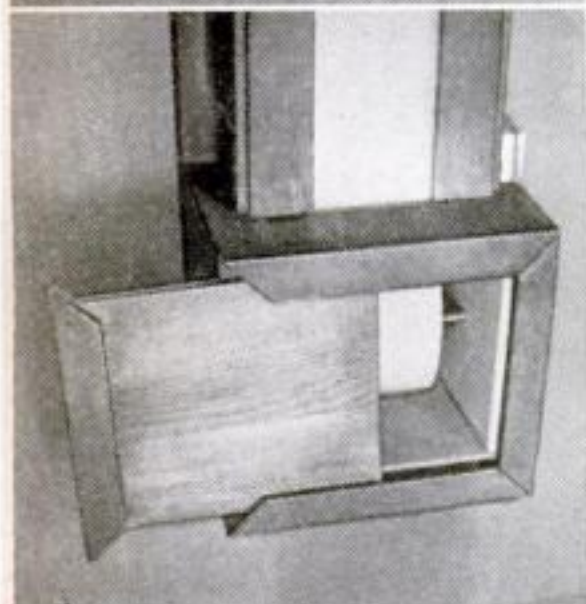
What Witches Made (See Previous Page)

MAGIC blocks *should* be carved from a crone's broomstick, but any scrap will do. Make identical blocks, drilling holes through the faces for cord and bolt. Bore hidden holes and, before plugging the ends or bolting the blocks together, clinch fine wire to one end of a nylon cord and feed it through, tugging the cord after.—*LaVern Smith, Indianapolis.*



Wall Caddy

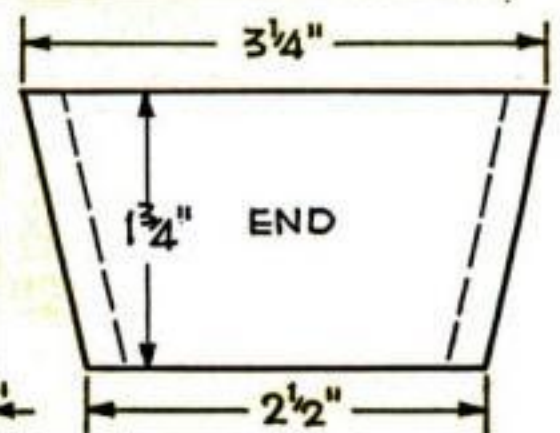
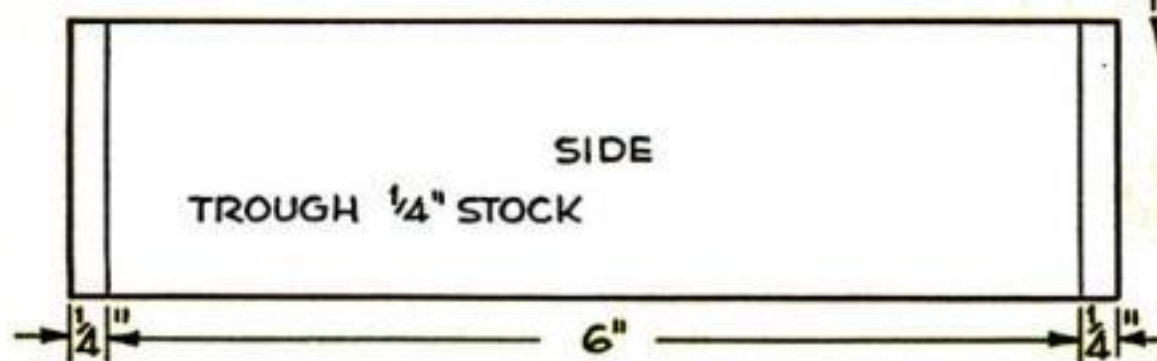
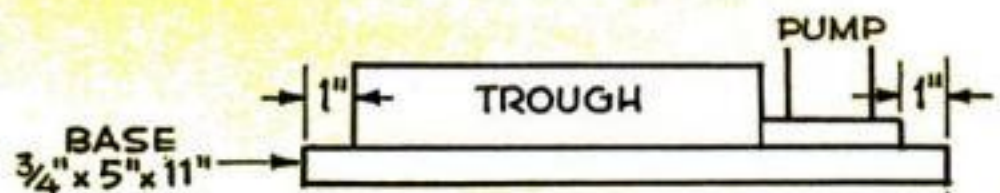
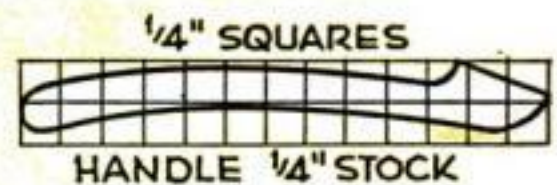
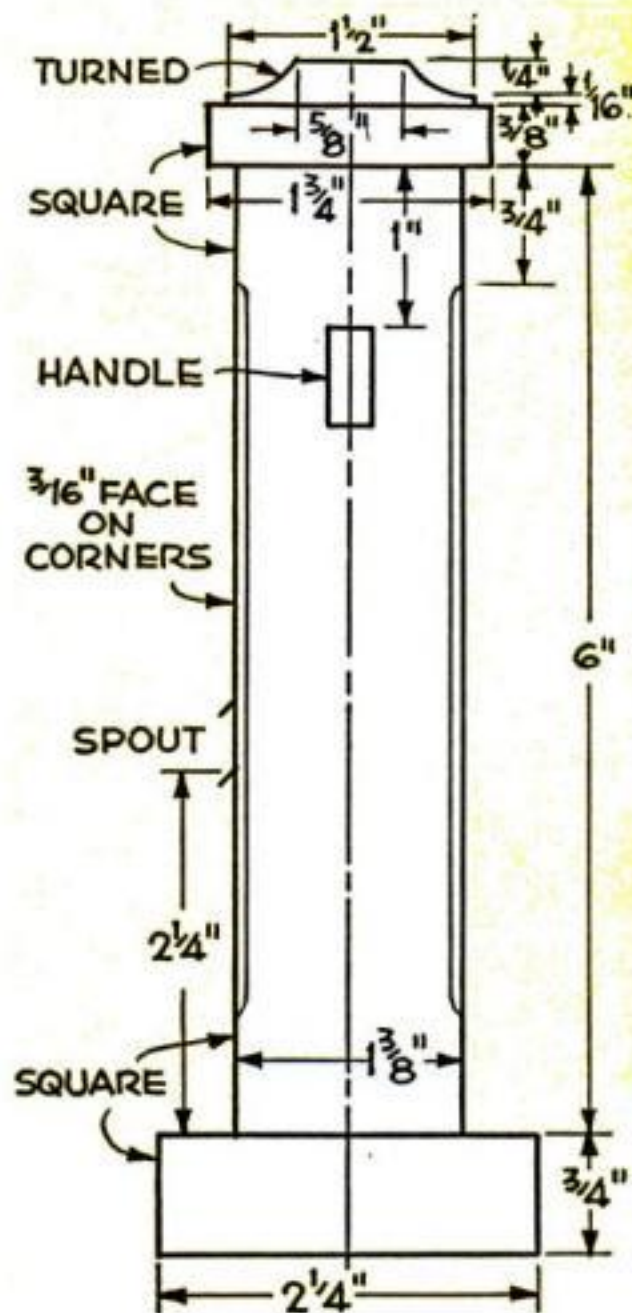
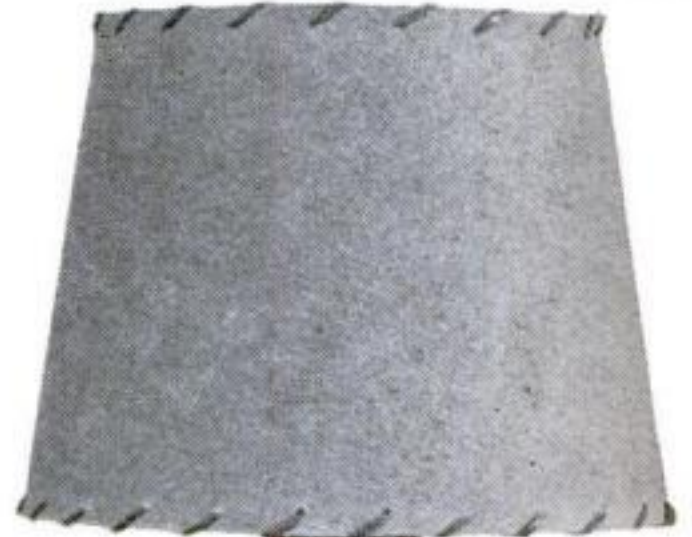
COMBINED in this one unit are a note-taker that reels off fresh paper, a rack to keep keys from straying, and storage for a carton of cigarettes. Cigarettes enter at top, leave—a pack at a time—through either side slot. When the roll of adding-machine paper needs replacing, slide away the front panel and withdraw the pivot rod. Be sure the tear-off strip clasps snugly so the paper won't wrinkle as it is torn off.—*E. E. Hickman, Farmington, Mich.*

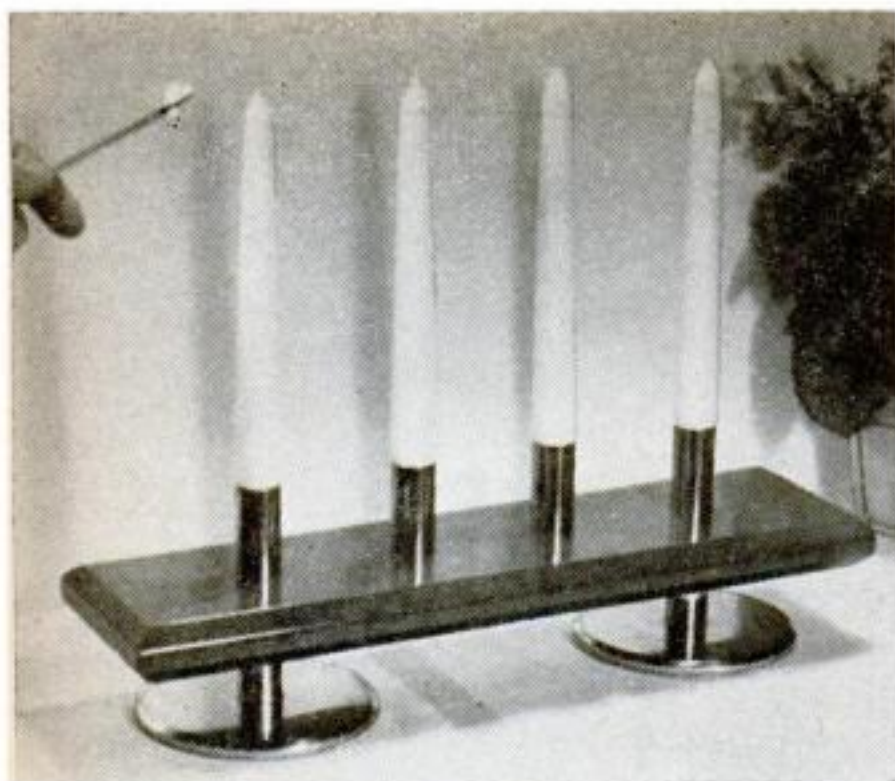


Town-Pump Lamp

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THE planter adds a realistic touch to this rustic lamp base. It gives the impression that the pump works. Actually, not even the handle does; like the spout, it's simply glued to the solid column. Drill a hole down through the column pieces and base, and insert an 8" length of pipe, threaded on each end. Provide a recess for a nut on the underside of the base, and drill a wire passage into this recess, from the edge. Screw a brass shell socket down tight on the top end of the pipe. Leave the wood a bit rough; seal with shellac and finish with a maple varnish stain. Line the planter with foil or heavy plastic wrap before you fill it with dirt.—Herbert Y. Moon, Orient, N.Y.

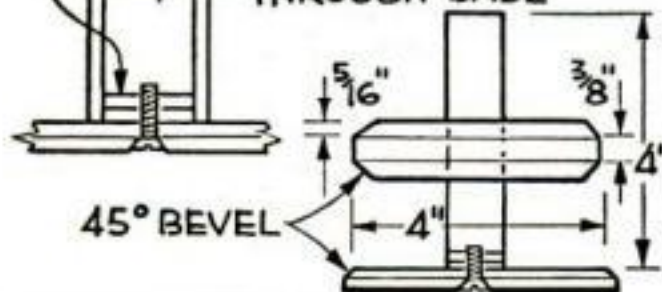




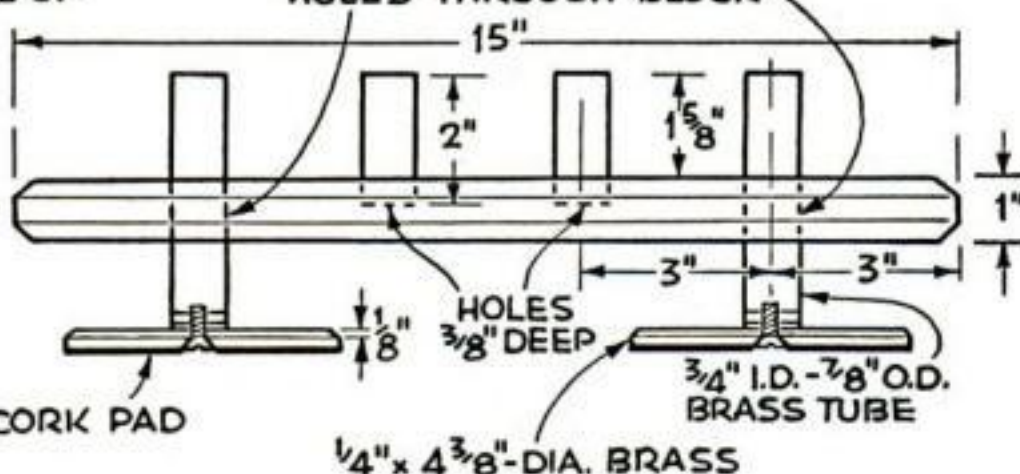
Modern Candelabrum

GLEAMING brass and straight-grained redwood combine to create a sleek pedestal candelabrum for the dinner table or buffet. Polish all metalwork before assembling it, and drill the four $\frac{7}{8}$ " holes for a tight fit. Before forcing the tubes into place, bevel the block, sand it thoroughly, and give it three coats of lacquer. Apply a final lacquer finish to both wood and brass.—Robert Micals, Freehold, N.J.

SOLDER $\frac{1}{8}$ "x $\frac{1}{2}$ "-WIDE BAR TO INSIDE OF TUBE, TAP FOR 10-32 SCREW THROUGH BASE

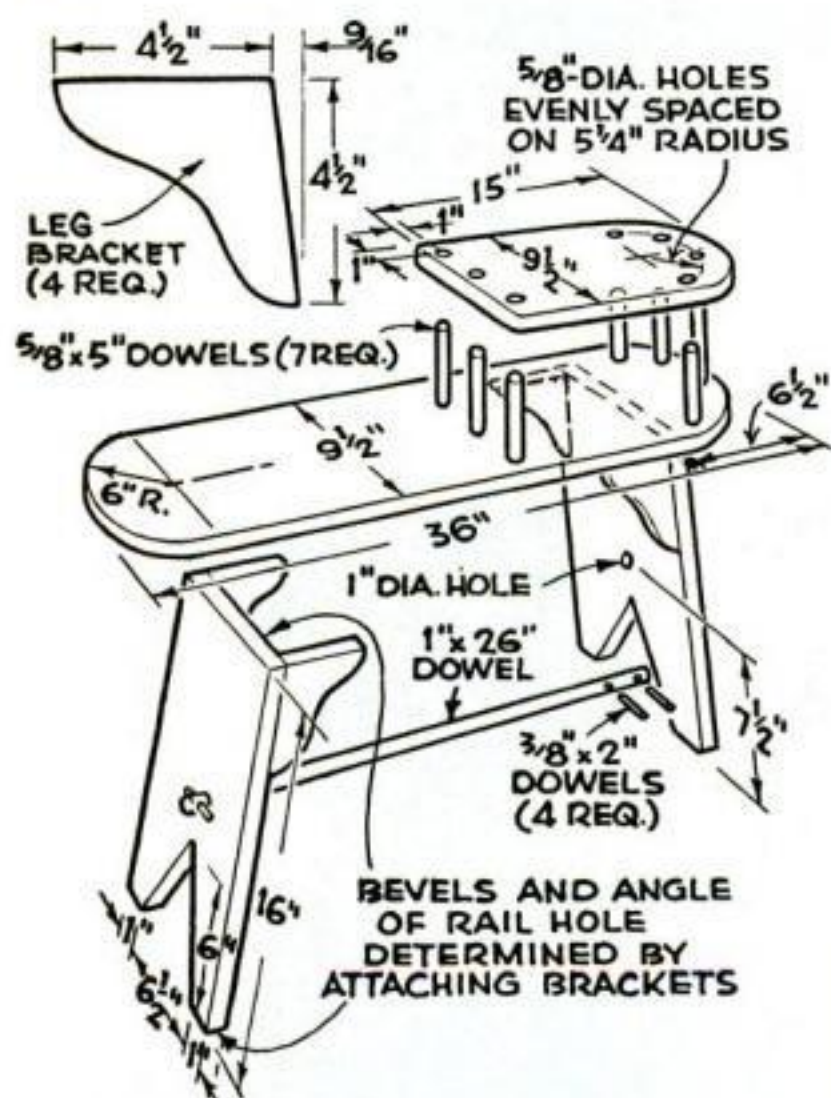


HOLES THROUGH BLOCK



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Telephone Bench



EARLY American in character, this gossip bench can be built of one-by-ten pine shelving, finished with an antique stain. Tack phone platform and bench top together before drilling, so that the dowel holes align. Cut and drill the dowel rail after the other parts are assembled.—Malcolm E. Wright, Rockford, Ill.



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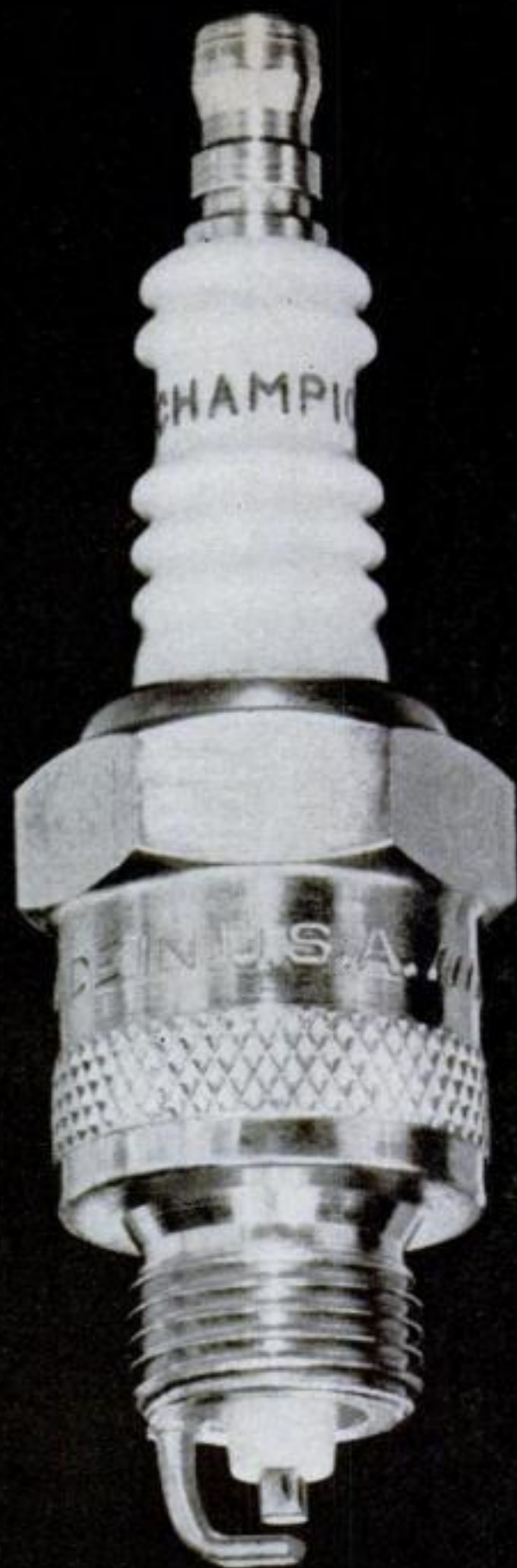
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Products of United States Plywood



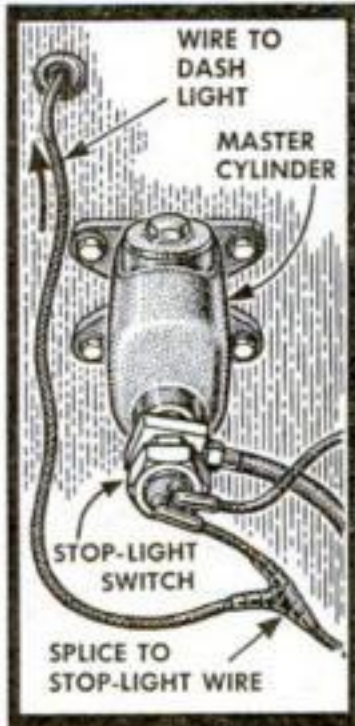
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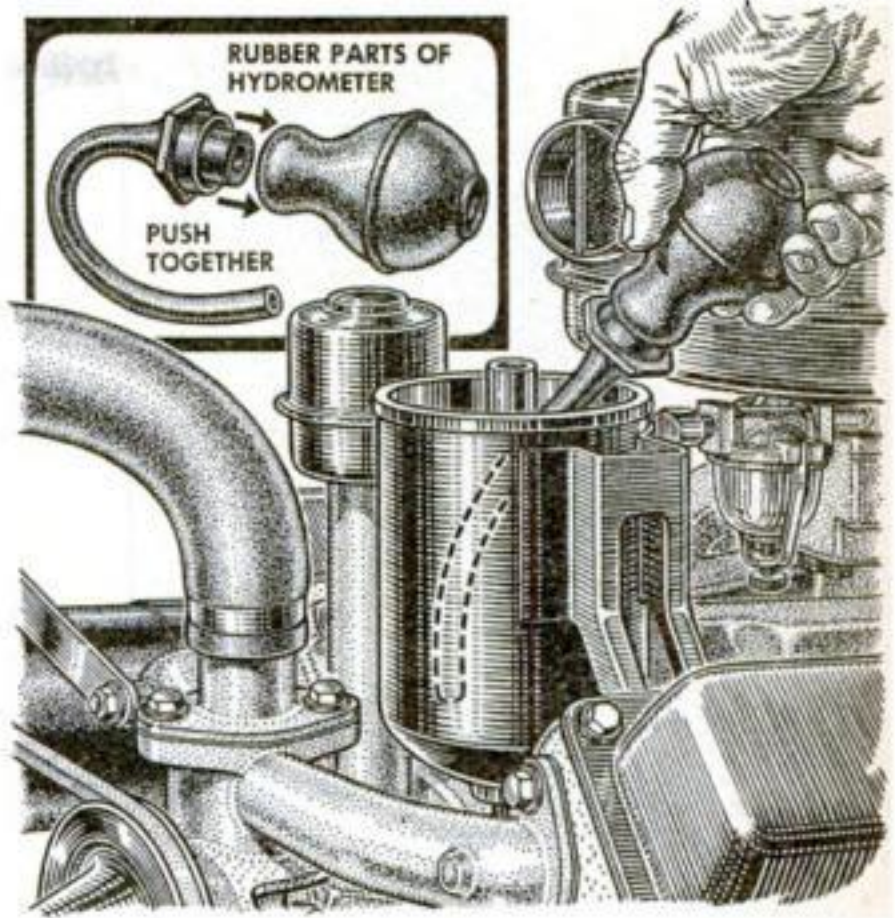
Hints from the Model Garage



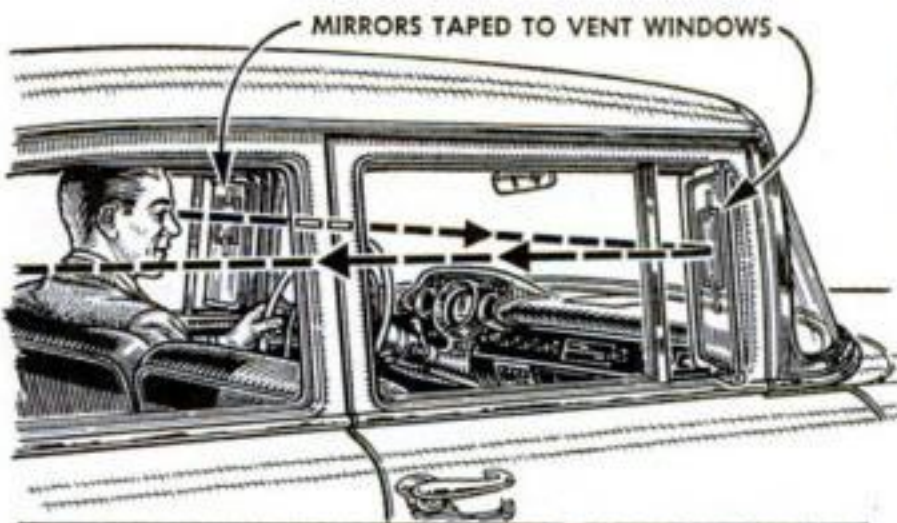
LIGHT GOES ON
WITH STOP LIGHTS



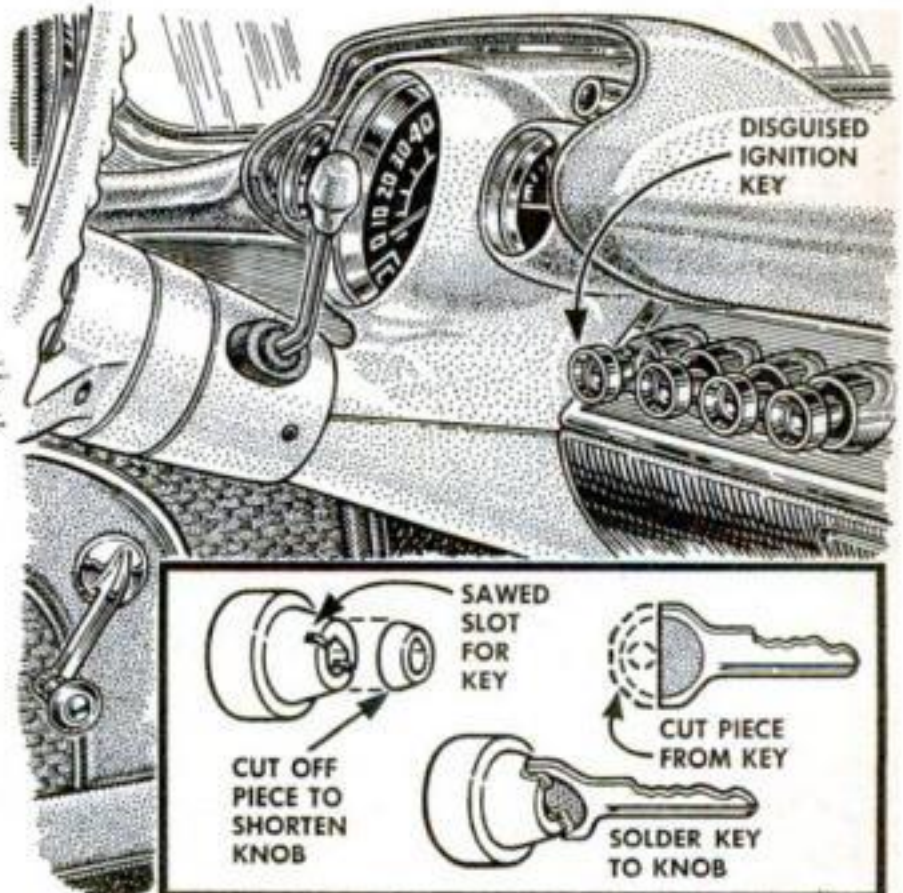
A light on the dash connected to the brake-light switch will indicate when stop lights go on. Knowing this, you can pump the pedal lightly to warn following drivers that you plan to stop before you apply full brake pressure.



Don't throw away the rubber ends of a battery hydrometer if the glass tube breaks. Press the tip into the bulb and you'll have a syringe for adding water to the battery or drawing dirty oil from the bottom of the filter housing.



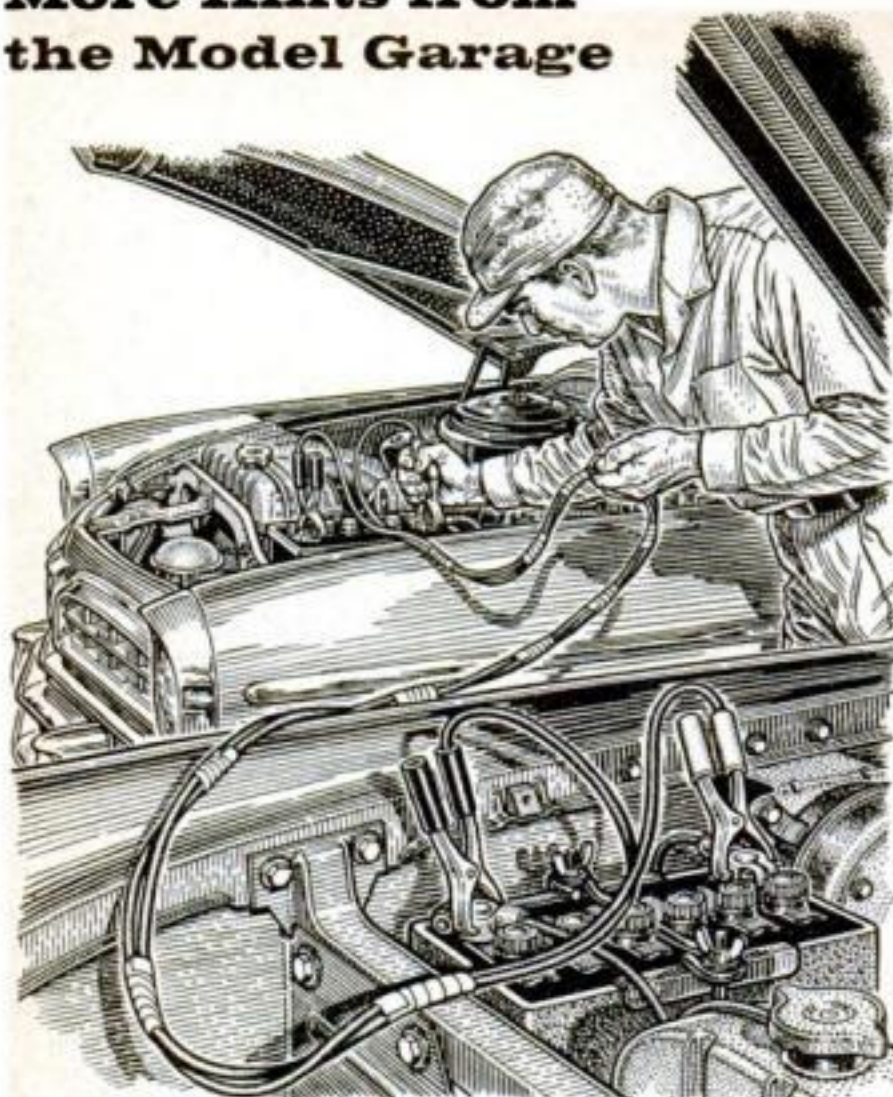
When towing a trailer or boat, you can command a full view of the rear on both sides by taping a small pocket mirror to the front vent windows. After determining the right height for the mirrors, adjust them by opening the windows.



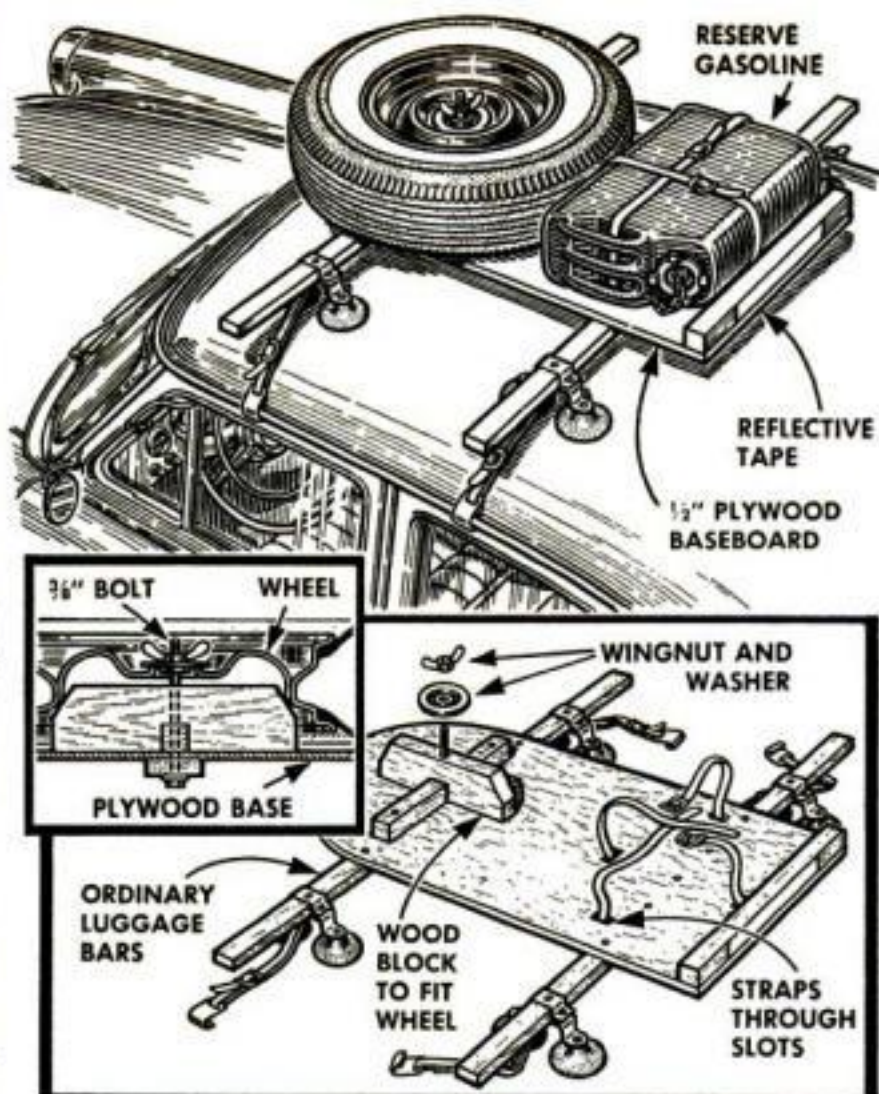
A car thief wouldn't think of starting your car by turning a knob on the dash. That's why you can leave this key in the ignition when making frequent stops. Get a matching knob and solder or cement the shank of a spare key to it.

CONTINUED

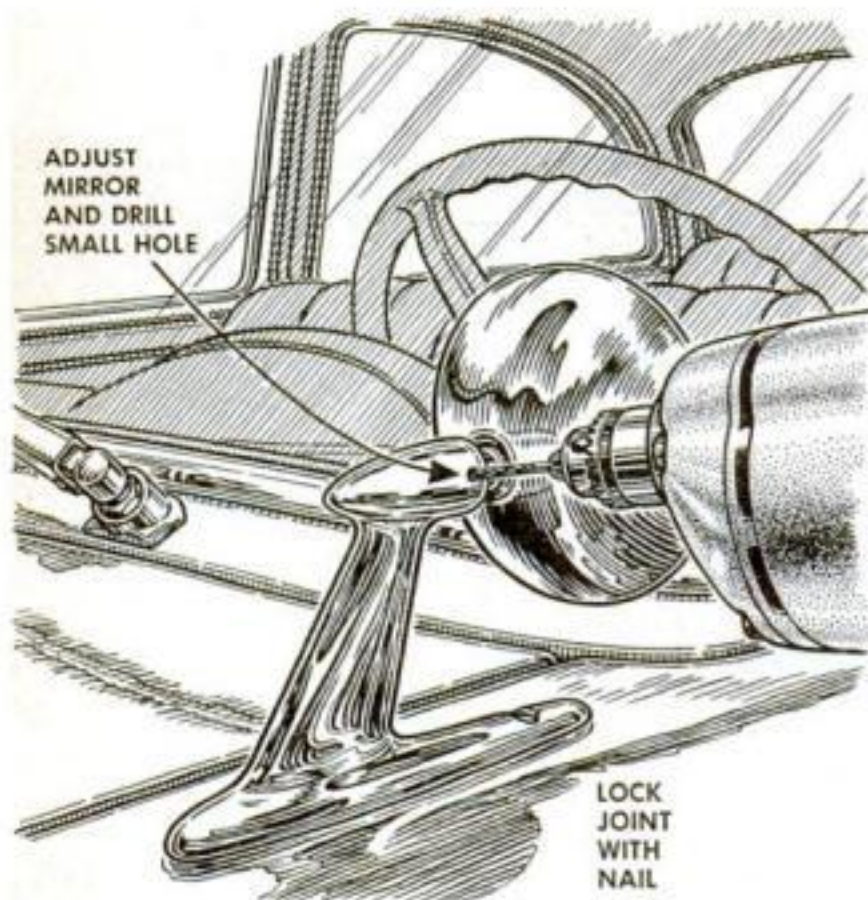
More Hints from the Model Garage



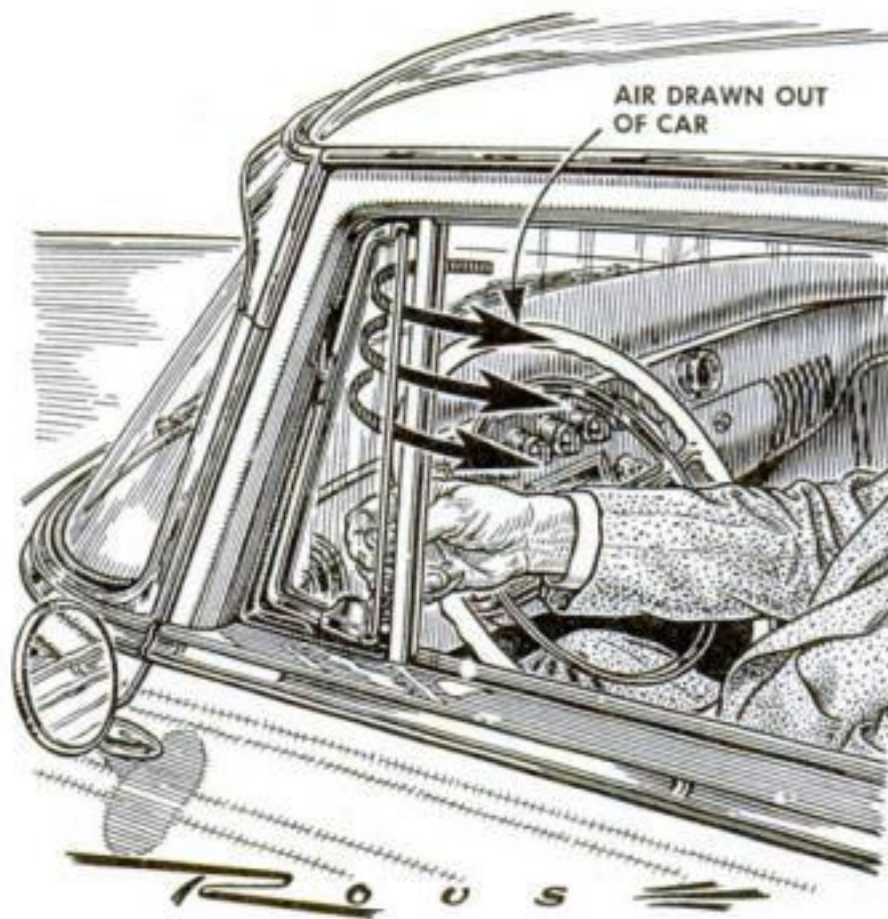
To keep a set of booster cables from becoming tangled when not in use, bind them together with electrician's tape at 12-inch intervals. Leave the ends free, so they can be separated far enough to reach the battery terminals.



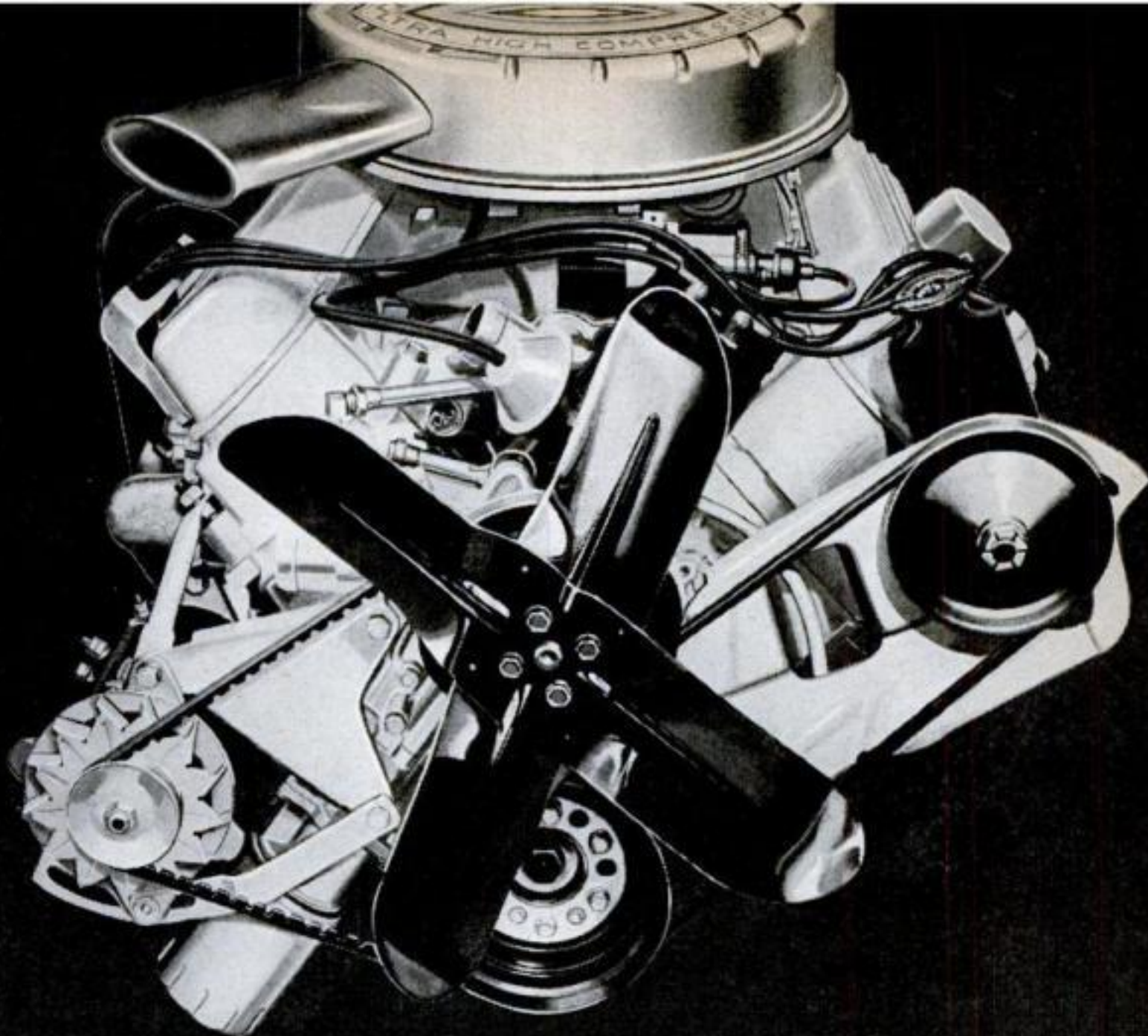
All the luggage around the spare tire will have to be unloaded if you have to change a flat on a trip. To avoid this, and to gain extra space for luggage, store the spare on top of the car, along with extra gas. Pack tools under a seat.



You can avoid the nuisance of readjusting the side-view mirror every time someone brushes against it by pinning it securely in position. Drill a small hole through the ball-and-socket joint and put a cotter pin or nail in the hole.



Heater performance can be greatly improved by opening the vent windows slightly. As air is drawn out of the car, a draft is created that increases the amount of fresh air that flows through the core of the heater.



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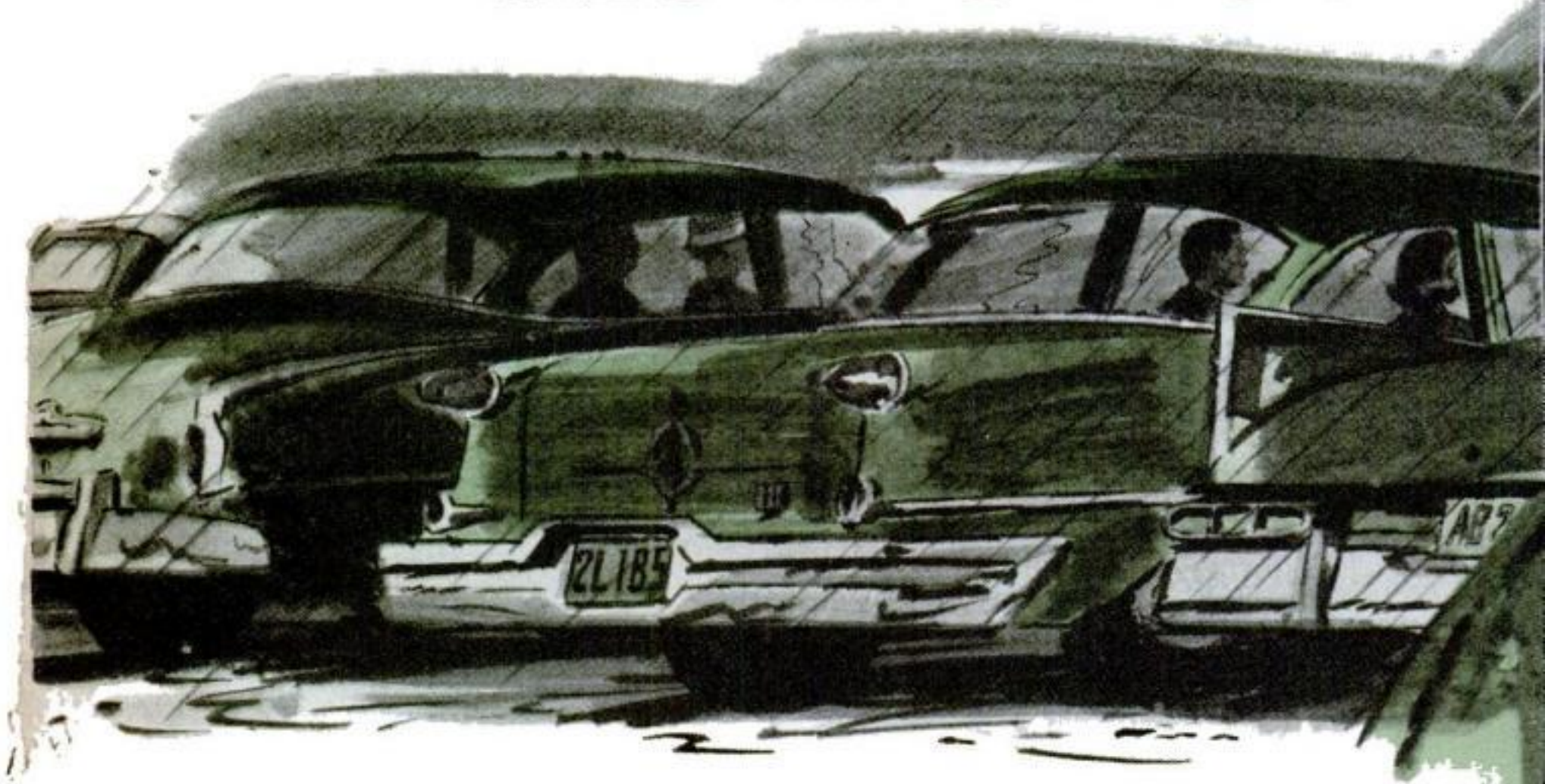


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There's **"SOMETHING EXTRA"** about owning an **OLDS**

Gus Goes to the Movies



By Martin Bunn

GUS Wilson rolled out from under a station wagon on the apron of the Model Garage. "Muffler and tailpipe are okay," he said. "Let's look inside."

Bill Ames moved over and Gus inspected the exhaust manifolds, crossover, and joints. Nowhere did the reddish surface show the sooty streaks of exhaust leaks.

"Everything's all right here, too," he reported. "What made you think of exhaust leaks?"

"My wife," answered Ames. "On long trips she rides in back to keep the kids under control. Gets a headache every time, even with the back window open."

Gus dropped the hood. "Try keeping that window shut, but one or two others at least part way open."

"She'll complain about drafts," said Ames. "The rear window ventilates but doesn't let in cold drafts."

"No, it lets in exhaust. These square-ended wagons have lots of suction drag. It pulls the exhaust along with you. An

open rear window makes a low-pressure area inside the car, so some gas gets in. It could cause your wife's headaches."

"It could? Well, now I know a busted muffler won't put me to sleep."

"Hold it!" warned Gus. "Safety isn't once-and-for-all. A rock could hole your muffler tomorrow, or open a joint. Any time the exhaust begins to bark, better check. And watch out for snowbanks."

"Snowbanks? Why?"

"Backing into one could plug that straight tailpipe solid," explained Gus. "That might stall your engine. But if it didn't, exhaust might seep into the car while you're spinning your wheels to get out of the drift."

"Okay," said Ames. "I'll watch out."

The brisk fall day wore on. At noon, Harry Towne, a sandy-haired young fireman, drove in his 1955 hardtop.

"Hey Stan," he called to Gus's young helper. "Check the points. Engine's getting sluggish."

Stan set to work and the young fireman watched. Everything checked out. "Nothing wrong with points, timing, valve clearances, and compression," said Stan.



With his flashlight, Gus trudged behind the last row of parked cars.

"Well, thanks," said Towne after a pause. "I've got to get back, but I wish you'd found something wrong because it sure isn't acting right."

"Leave it. I'll check the gas line and fuel pump," suggested Stan.

AS THE fireman left, the phone rang and Gus picked it up. He recognized the tense voice of Tom Hawley, the Model Garage's fussiest customer.

"Get over here fast, Gus," he said. "Something awful's happened."

Knowing this might mean no more

than a scratch on Hawley's beloved and pampered '39 Caddy, Gus asked for details.

"I broke a spark plug! In the engine. Can't get it out," spluttered Hawley. "I was cleaning plugs. When I tightened this one, it broke in two!"

Gus groaned. Hawley made a fetish of the sleek old sedan, bringing it to the shop only for lubrication. He did routine work on it himself.

"I'll send Stan over," said Gus.

The phone made strangled noises about hurrying. Gus could imagine Hawley.

He'd be almost in pain as long as that broken shell remained in the engine.

Stan grinned on hearing of Hawley's predicament. "He sure loves that crate."

"What's wrong with that?" asked Gus. "Anyway, go easy on it—and on him. I'll check Towne's car meanwhile."

GUS found both gas line and pump on the fireman's car were delivering gas well. Puzzled, he turned his light on the exhaust manifolds.

At two block joints and the pipe coupling, black streaks darkened the red-burnt metal.

"Back pressure," thought Gus.

He put the car on a lift. The muffler was intact. The tailpipe looped up over the rear axle and straightened behind it. Its oblique end was bent down at the tip as if it had hit something, but not enough to constrict it.

Returning to the bend over the axle, Gus moved his finger up along it. At the top, the curve flattened into two side points. Whatever had bent down the tailpipe had creased the bend, narrowing the pipe there to a mere slit. As he stood staring at it, Stan drove in.

"Can't work for that guy, Boss," he reported. "I offered to let him use the extractor himself, but he was shaking too much. When I began twisting it, he turned green and stopped me. He's afraid chips will get into the cylinder."

"How about putting thick grease on the extractor to hold them?"

Stan shook his head. "I'm afraid he'd faint, Gus. Anyway, he wants you."

"Okay. Towne's trouble is back pressure from a kinked tailpipe. He should get a new one in right away."

STANDING regally in the driveway of Hawley's garage was the Cadillac, its front fenders protected with white cloths. It reminded Gus of the time he'd pushed the car a block—after Hawley rounded up four blankets to protect the Caddy's spotless bumper.

Hawley paced beside it, his spare figure bent as if burdened, droopy mustache quivering. "Thank heaven you've come. Your helper means well—but chips could ruin the cylinder wall. There must be a better way."

Gus examined the stub in the plug hole. "No chips torn out, Mr. Hawley. But maybe there is another way."

From his kit Gus took an adjustable wrench, a hammer, and a big rasp. Knocking off the handle of the rasp, he inserted the thick tang in the broken plug shell. Beside him Hawley breathed noisily as Gus tapped the four-cornered tang tight.

Closing the wrench on the rasp near the shell, Gus applied turning force. A gasp made him look at Hawley. Under the mustache his lips twitched.

Gus increased torque. The tang's corners held, slowly

turning the shell. Soon he could screw it out by hand. Hawley exploded in a sigh of relief.

WHEN Gus returned to the garage, he saw that Towne's car was gone.

"He had some errands to do before his date tonight," explained Stan. "But he'll bring it back tomorrow for a new tailpipe. He remembers bumping that high curb at the firehouse, but thought it only bent the pipe end."

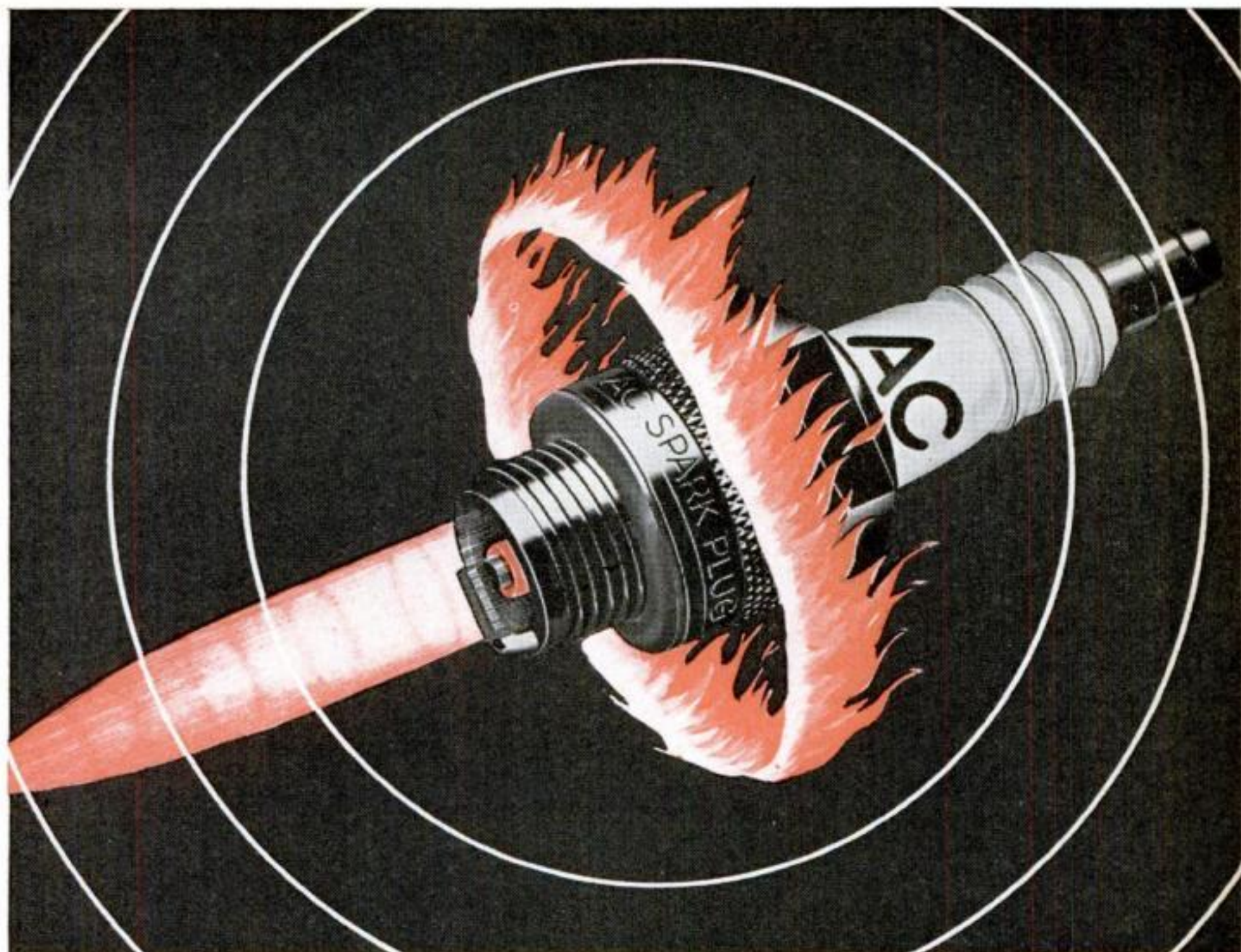
Gus grunted. "He'd better drive with a window open tonight."

Where'd it come from?



Plus and minus

The plus and minus signs are supposed to have been used first in Holland in the 15th century. They were a shorthand for marking down excess or short weight in bales of goods. Thus if a bale were supposed to weigh four centners (400 lb.) but was five pounds over, it would be marked 4 c. + 5. If it were under by the same amount, it would be marked 4 c. - 5. The signs were used in a similar sense in an arithmetic book published in Leipzig in 1489. About the middle of the next century they became recognized as formal signs of operation—i.e., as indications to perform addition or subtraction.



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"Don't worry." Stan said, grinning. "He won't be driving much."

By closing time a damp chill hung in the air. Gus ate dinner, wondering why he felt uneasy. About Towne's car?

"I'm a soft-headed fool," thought Gus, and telephoned Stan.

"Why'd you say Towne won't be driving far?" asked Gus.

Stan chuckled. "He's taking his girl to the Town-Line Drive-In. It's the last show of the season. Getting too cold for outdoor movies."

As Gus hung up and switched on tele-

aged man and woman glared at him through the rain-flecked window.

Towne's car wasn't in the last row. Gus walked up the next as rapidly as he could pick out tailpipes. Another bent one was on a convertible. He started on the third row, oblivious to the gigantic picture at his side, to whispering speakers left on stanchions.

The twentieth car had a bent tailpipe, exhaust muttering. A hardtop. Without his light, Gus could make out a man and a woman inside, heads together, motionless behind the clicking wipers. He rapped on the glass. They paid no attention.

Gus turned the light on them. The man was Harry Towne, eyes closed, his face peaceful.

Yanking the door open, Gus noted a faint smell of exhaust inside. Towne didn't budge. Reaching over, Gus flung the other door wide, switched off the ignition, turned on headlights. Horns blared protest. He half dragged Towne out onto the ground, went back for the sleeping girl.

"THE hospital says they're doing fine," reported Stan next morning.

"But it was close. How could a smart apple be taken in that way?"

"Habit," said Gus. "He was used to idling the engine to keep the windshield clear and the car warm. Maybe he just forgot—or thought if he got dopey he'd have time to shut off the engine. But carbon monoxide's treacherous."

"Boss, you got a crystal ball?"

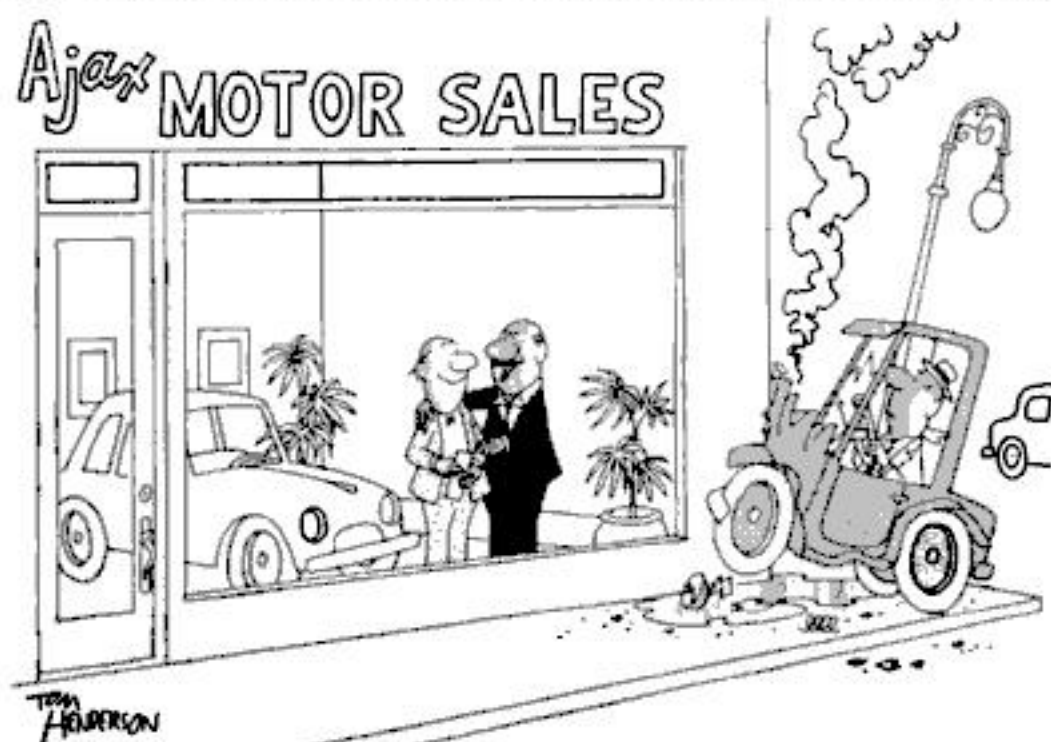
"It wasn't working," snorted Gus. "But the pattern bothered me—a cold, rainy night, the car parked, a girl to keep comfortable, back pressure bottled up in a leaking exhaust system. But it took a TV show to get me moving."

"I suppose it showed you the spot Harry was in," said Stan sarcastically.

"Sure. It began with a fight in a garage. Hero was knocked out and left with a car engine running. Darn!"

"What's the matter?"

"I'll never know how my pet private eye got out of that one alive!" ■ ■



"All right, Cummins—now get out there and do your stuff!"

vision, rain began drumming on the windows. The TV picture unfurled into violent action. But it was better, thought Gus, than seeing a movie through a windshield on a night like this.

Suddenly he stood up, stared at the TV screen, and switched it off. Putting on a raincoat, he went to his car.

THE great crescent of the drive-in lay under a curtain of rain. Gus paid, drove to the projection shack, knocked on the door until a man opened it.

He wasn't helpful. "We got 600 cars here. You want to look, go ahead. I can't put a notice on the screen until the picture's over, unless it's something official."

Gus trudged behind the last row of cars, aiming the beam of his flashlight at rear bumpers.

Then the light found a tailpipe with the tip bent down, exhaust burbling. Gus swung the beam into the car. A middle-

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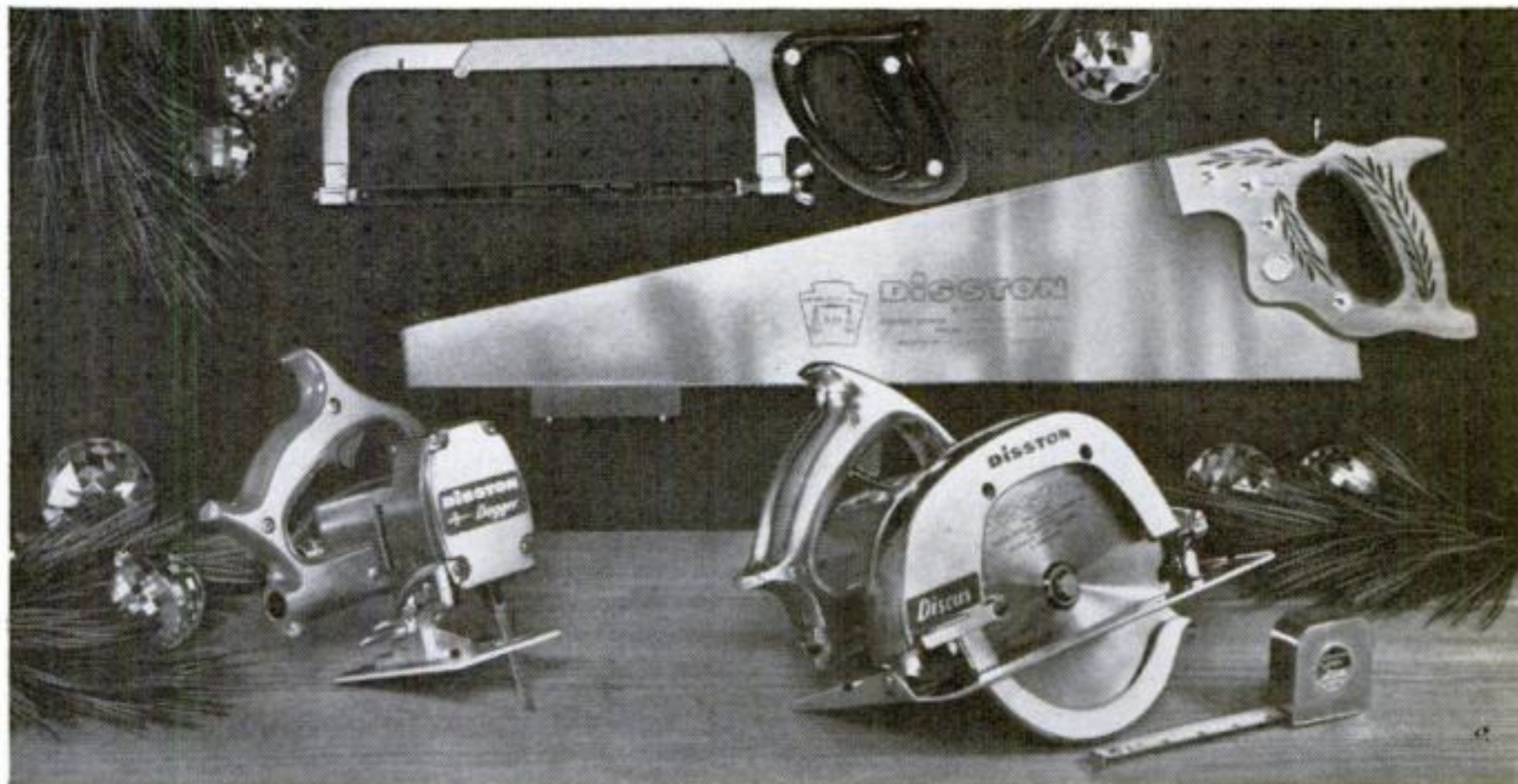
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around town—all short trips—I noticed consistently higher readings on the V-8 than I had gotten during my tests. It took a few days before the probable explanation dawned on me: The automatic choke was sluggish and the engine was not getting hot enough on short trips to open it fully. I moved the choke adjustment several notches toward the leaner side and squirted some solvent on the linkage. That did it. Now that I'm looking for it, I can "see" the choke open in the first block or so by watching the meter. So I figure that in a year's time the meter will have saved me a lot of fuel just by calling my attention to an unnoticed fault.

Spark plugs and fuel. This ability to report abnormal operation before it becomes noticeable can save money two ways. For example, one of the first things that occurred to me when I got the Drive Master was to see what effect worn spark plugs had on fuel economy. I had 10,000 miles on the plugs in my compact and they had never been out of the engine.

I made a level road check at 10-m.p.h. intervals between 30 and 70 m.p.h. with the old plugs in place, and then repeated the test with new plugs. Result: no difference in fuel economy at any speed.

But before you jump to the conclusion that worn spark plugs don't waste gas, a similar test was made on a borrowed car and the mileage increased better than 20 percent. Moral: New plugs will save fuel only if the old ones aren't doing their job right. With continuous monitoring by the Drive Master, you can *know* when something is amiss and not waste money on rule-of-thumb tune ups and maintenance.

The flow meter gave the clue to another fault on this same car that had gone unnoticed by the owner. The car gulped gas at an alarming rate on hard acceleration and at high speeds. In fact, the rate was higher on acceleration after the plugs were changed than before. This was a puzzler at first, but if you'll think about it a minute, you'll come to the same conclusion we did—the clutch was slipping. This proved to be the case.

New quirks and foibles. Aside from the dollars-and-cents angle, the instrument offers intriguing prospects to the Satur-

day mechanic for exploring the quirks of car operation. I found, for example, that it costs me about one extra mile per gallon to drive my convertible at 60 m.p.h. with the top down. But the air conditioner makes no detectable difference at highway speeds. It's often cheaper to shift into second on hills if you're traveling below about 30. Wide variations in load make little difference in fuel consumption—except on acceleration, when heavy loads cost you. Different brands of gasoline made no detectable difference in mileage.

Why has a successful flow meter for automobile engines been so long in coming? It's the tiny flow rates involved. To get some idea of the delicacy of the task, an engine burning fuel at the rate of one gallon per hour will draw out a liquid thread of gas three miles long and .0012 inch in diameter in an hour's operation. This is the tiny thread that must be measured by the sensor to give an indication of one g.p.h. on the instrument dial. When you step on the accelerator, the sensor must instantly adjust to the new rate.

Theodore Ongaro, president of Ongaro Dynamic Industries and inventor of the Drive Master, has been working on the problem for 30 years. At least a hundred other men have sought patents for a measurement system that would do the job. Some meters worked, but none were inexpensive and rugged enough for routine installation on the average car.

After years of trying different approaches, Ongaro finally found the answer last year. The secret is a mechanically variable orifice. The size of the orifice changes in response to changes in the flow rate. A close-fitting piston moves inside a cylinder with three tapered grooves in the side walls. For low rates of flow the piston assumes a position where the grooves are shallow. As the rate increases, it moves to uncover the progressively deeper groove.

The position of the free-floating piston, and hence the size of the orifice, is sensed electrically. The wiper arm of a potentiometer is attached directly to the piston and changes the electrical resistance in the meter circuit as the piston moves up and down. ■ ■

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Straight-Line Electric Motor

[Continued from page 78]

them, and the locomotive, along the strip armature.

Mechanically, this linear motor is the opposite of the induction motor. Its field coils move in a straight line along the stationary armature. In the induction motor, stationary field coils spin the armature in a circle. Yet there is no real difference in the electrical action.

An induction motor, linear or rotary, uses three-phase alternating current to power separate sets of electromagnet coils. That makes the magnetic force from each set of coils always different from the others. And the magnetic force from each set is always changing because the current is AC. The result is a ripple of magnetism traveling along the coils. The effect can be likened to a solid horseshoe magnet being moved through space.

Moving magnetism induces an electric current in any conductor nearby. So currents are induced in the induction motor's armature. Attraction and repulsion between the currents in the armature and the magnetism of the coils pulls the coils along the armature.

Braking is no problem. You just reverse the current with a switch. Speed control is tricky, however.

The moving part of an induction motor is carried along by the magnetic ripples, and moves almost as fast as they do (there's some slippage). The speed of the ripples is set by the rate at which the current alternates (the power frequency) and by the spacing of the electromagnet coils.

The greater the spacing of the coils, the farther a ripple will travel in one current alternation. You can't adjust the line frequency easily, but you can alter connections to the coils to change their spacing electrically. So you could speed up or slow down a linear-motor locomotive by switching connections, much the same way as you shift gears in a car.

A new concept? Linear motors are an old idea, going back to the induction motor itself—but apparently a neglected idea. A few variations have been tried over the years.

Some German machines get reciprocating motion electrically with "partial motors"—the field coils and armatures are curved but don't close into complete cyl-

Straight-Line Electric Motor

inders. Tubular motors, in which the field coils are shaped to make the magnetic ripple move down the length of the tube, are used as pumps for liquid metals. The liquid metals themselves serve as the moving armatures.

Two real linear-motor railroads have also been built. One was a quarter-mile long. But its single car stood only 5½ inches high and was meant to carry fighter planes, not commuters. It was a catapult, ordered by the Navy during World War II to launch heavily loaded planes from short runways that were built on Pacific atolls.

These "Electropulsts," made by Westinghouse, were fearsome machines. The car developed 10,000 hp. and hit 225 m.p.h. Current draw at top speed was 7,000 amperes, and went to 10,000 amps for dynamic braking. The catapults never saw combat, but were used to assist take-offs of experimental craft.

Why was the idea abandoned? P. G. Lessmann, present engineering manager of the Westinghouse division that built the machines, gives a classic answer: "Costs too much money, weighs too much, takes too much power."

The British carry on. American skepticism doesn't faze Laithwaite, who has already built working models of several machines that use direct straight-line motion. Among them are:

- An eight-foot tubular electric blowgun that can shoot copper rods with a muzzle velocity of 150 feet per second. A larger version might be used to help launch spaceships.

- A conveyor belt that doubles as its own drive motor. The copper-mesh belt is the armature, pushed along by field coils underneath.

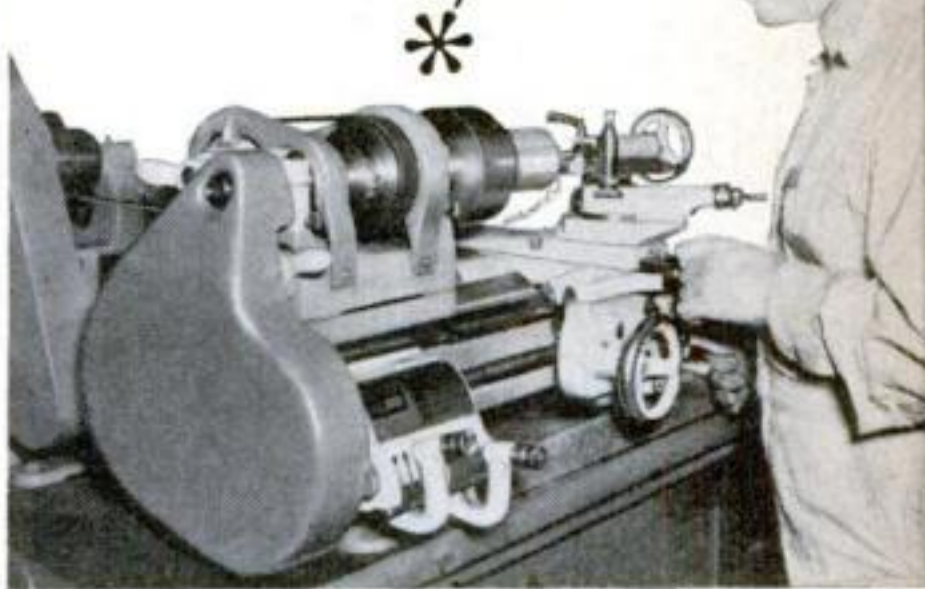
- Two linear motors placed end to end, with fields opposed, that shuttle a "package winder" back and forth. This gadget winds yarn onto a bobbin 50 percent faster than standard cam-actuated machines. Electromagnetic shuttles for looms are also a possibility.

But the most exciting promise of the linear motor is the high-speed express train. The coming tests should prove whether it will indeed cost too much in money, weight, and power—or open a thrilling new era of fast, smooth, and quiet travel.—David Scott. ■ ■

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Skyhook Plucks Pilot Out of Trouble

[Continued from page 107]

moves 80 feet horizontally. Says Fulton, "The load always follows the lift line. If, because of wind, the lift line curves inward toward the airplane, the load will actually travel backward along that curve during the first few feet of climb. That's why we can pluck a downed pilot out of a tiny forest clearing."

A long lift line—he experimented with a line 1,000 feet long for a while—solved the problem of straight-up lift-off. But the lift-off G load was worrisome. To measure it, Fulton, a pilot himself, attached an early version of his device to the wing of his Stinson Reliant, ran up a lift line with a toy balloon, and lifted a 10-lb. load off the airstrip beside his shop. To measure the G-load, he taped a pencil to the pointer of a fish scale.

When he landed, he found that the heaviest load measured by the scale and marked by the moving pencil was 70 lb., or seven Gs. The figure stood up remarkably well during the following years of experiment.

Going up! G-force hits a peak of about 10.5 and averages about 6.5 when a human being is picked up by a P2V—compared to peaks of 26-30 Gs in a parachute jump, says Fulton. Peak load lasts about one-half second—much less than the peak load in a bail-out. Riding the Skyhook to a plane is like taking a fast elevator.

For the pilot of the rescue plane, Skyhook pickups are a cinch. Nosing down slightly for better visibility, he keeps his plane lined up with the balloon. A few seconds before contact, he sees the white nylon lift line and brackets it with a 25-foot-wide yoke bolted to the nose of the plane. When the line slips into the crotch of the yoke, a mechanism (its details are secret) grips it and hangs on firmly.

There is little contact shock in the plane. Pilots say pickup is about like hitting a wet handkerchief. On contact, the balloon breaks up and the pieces drift slowly away.

Pilots were not always so casual about the new device. When Fulton first got permission to attach a Skyanchor yoke to a P2V at El Centro, Calif., Cmdr. Marion Buaas told him he had better

fly his Stinson and show the boys that the test version really worked. Says Fulton drily: "There was some reluctance on the part of Navy pilots to tangle with a balloon and 500 feet of nylon line at 150 m.p.h.—until I showed them it could be done with my little putt-putt."

Fast pickup. After contact, the lift line streams out almost horizontally behind the plane, bringing it within a foot or two of the hatch door. With a J hook and a couple of snatch blocks, the crew picks up the lift line, feeds it through a pulley in the bulkhead and onto a Fulton-designed electric winch, punches the start button, and hauls away. Average reel-in time is about six minutes.

The winch, which runs off the plane's power supply, presented a problem. At the start of the reel-in, each revolution of the barrel brings in about nine inches of lift line. But as the line piles up on the barrel, the barrel size increases in effect and hauls in about four feet of lift line with each revolution—just at the time when the load is nearing the plane. Fulton built the simplest gearshift possible—a device that flips the line over onto a fresh barrel, thus reducing in-speed. This brings it back again to nine inches per revolution.

The crew always gets a charge out of watching the load "slip up the lift line" toward the plane, appear in the hatch, and finally swing aboard. But one crew during an early test at Quantico, Va., got the biggest charge of all. At the end of a day's testing, Fulton, on the ground, quietly removed the test sandbags from the pickup harness and substituted a case of cold beer. He swears he could hear the cries of joy through the open hatch as the plane circled to land.

Skyhook equipment has been installed on all kinds of aircraft, both one-props and multi-engines. Sixty-five pickups have been made at night. Last fall, six pickups were made in Alaska—one from the deck of an icebreaker, others through fog so thick that the pilot could not see the load on the ground.

Volunteers say that riding Skyhook is like making a gigantic high jump—and never coming down. Fulton thinks that some day Skyhooking may become a sport, like parachute jumping. ■ ■

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Miracle Hi-Fi Speaker?

[Continued from page 170]

on its loose baffle out of the cabinet. It was a cheap 7" elliptical from a car radio!

What's the secret? Gough can't explain, except to say that the cabinet does *not* work on horn loading or on a folded air column. He thinks that it either has no resonance or else resonates at all frequencies. In any case the fundamental resonance of the loudspeaker does not appear.

Construction of the enclosure breaks all the cabinetmaking rules of the high priests of high fidelity. Except for the speaker baffle and hinged lid, all joints are right-angled, and require only gluing and nailing. Glue, in fact, is used solely for mechanical and not for acoustical reasons. Gough claims that a quarter-inch gap at the seams would make no difference.

The shape of the cabinet is everything, he says; the size not important. The standard unit designed for an 8" speaker can be scaled up or down to suit a larger or smaller speaker. A scaled-down enclosure might even be built into a car trunk, with the rear deck supporting the speaker and the raked window acting as the reflector.

The loudspeaker itself is apparently not critical. Gough won't recommend one by name, just prescribes "any good-quality" 8-incher. His files show that builders report excellent results with many different types.

Last year an engineer from a leading speaker manufacturer tried one of their medium-priced 8-inchers in the cabinet. He was startled to find that its advertised response (40 to 16,000, cycles) had spread to 15 to 22,000.

Some are anti-Gough. Not everyone thinks that the Welshman has found the philosopher's stone. Several British technical journals have attacked the cabinet, and controversy rages in their letter columns. The editor of a hi-fi magazine wrote: "If you want perfection you must be prepared to pay for it. There are no short cuts." And later: "I have not heard Mr. Gough's enclosure, but my experts have; and they were not impressed."

British industry, too, has been sour. "It is tommyrot to say that Gough has stepped past basic principles," snorted

one electronics firm. Loudspeaker companies have held aloof, despite the glowing private report of an engineer from one of them. He lauded "the remarkable crispness and attack," and continued: "Transients were excellently reproduced. Percussion and brass sounded better than anything I have heard. . . This speaker seems to be an unmistakable advance on present design."

The reaction of the kerosene-lamp makers to Edison's electric bulb? Gough hints at that, but isn't grinding any axes. He can't answer his critics with theory or mathematics.

One of his friends, a university professor, told me: "Jabez is not bogged down by the normal scientific approach, and has no respect for tradition. He gropes his way through theory with his own practical methods."

Gough laughs at the suggestion that he is a missionary, crank, or zealot. "I'm happy just to be the inventor," he replies, "I don't want to be in the cabinetmaking racket." He has had a few enclosures made up that he sells in his store, but only to meet the local demand.

What he really wants is some loudspeaker company to mass-produce his patented enclosure under license, and to design a speaker to suit it. For full exploitation of the cabinet's potential, Gough argues, the speaker should have a much lighter cone and voice coil than any on the market. Only then will his dream of audio perfection be realized.

Dragline with big bite



A 1,750-ton giant with a 303-foot cantilever jib, this dragline has a bucket that digs 33 tons at a fill. A pair of 57-ton "feet," 48 feet long and 9 feet wide, enable it to "walk" 2 yards a minute. Made in Britain by Tubewrights, the machine is used in ironstone quarries.

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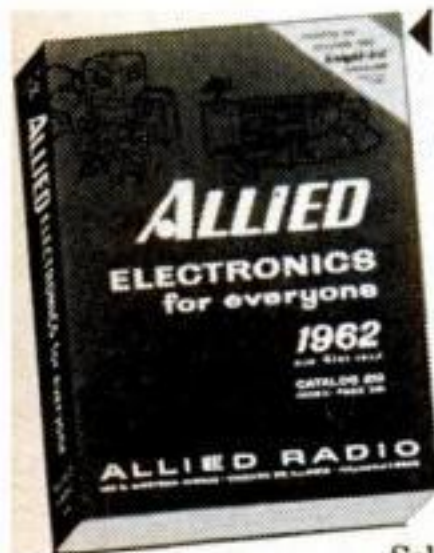
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**WORLD'S
BIGGEST**

Record Ride on a Super-Freight

[Continued from page 96]

to doze. I climb up top, open the slide window. The night air smells good. Corky shouts: "Let me know right away if you see fire or sparks." I watch the train. The big blue box is rolling heavily.

2:10 a.m. The train slows. We sail into Phillipsburg. The Pennsylvania lines now have taken us over. And we are exactly one hour ahead of schedule. But now comes a blow. The moorings on one piggyback need tightening. We lose a heartbreaking 46 minutes.

For the next 850 miles, all along the route, operating men and officials will be trying to help us get back those 46 minutes. A key point will be Altoona, Pa. "Wait and see," our crew say. "It's like a baby being born for everybody when this Jet comes into Altoona."

We wheel south on the "Belvidere route"—an old single-track line now improved to take the Jet. Tracks have been strengthened, curves rebuilt, bridges raised.

Dawn is in the hills when the train abruptly stops—then proceeds very slowly. Our engine is moving under the first tight bridge. Now comes the test for our big blue box—will it clear?

WE'RE on a curve, and we're relying on the tipped tracks—the "bank"—to get that extra inch of trailer under the bridge. The trailer leans. We see the engine crew peering back, prepared for a sudden stop. In our cabin, all hands look ahead. At dead slow, the blue box plugs up the bridge . . . a hairline of daylight appears over it . . . it's through—with a fraction to spare! Later we squeeze the big fellow through tunnels with the same care.

4:10 a.m. At last we slide out on the slick four-track main line of the Pennsylvania.

Trenton . . . Philly . . . Harrisburg. Chasing us now is the fast Duquesne Limited. We have a train phone in this cabin and we can hear him, right behind us, talking to towers along the route.

11:50 a.m. Altoona ahead.

Suddenly our cabin seems strangely quiet. We look up. We are sailing into Altoona all by ourselves in the cabin car—no train. The Jet has run off and left us.

Record Ride on a Super-Freight

What's happened? We've made a "flying cutoff." Our flagman, using special levers, closed a valve in the train's air line, "pulled the pin" and opened our coupler. Then he'd wound up our hand-brake. Wheels clicking, we drift to a stop. The Jet stops a quarter mile ahead.

"Jump off fast," says our crew, "or she'll leave you."

Already we see an engine charging down the next track, pushing a new cabin, to switch it over and catch the Jet. Another passing engine rushes Bill and me up to the "head end"—for from here to Chicago we'll ride the locomotive. *In 2 minutes 10 seconds from the time we jumped off the old cabin car, the Jet blows her whistle—and is moving again,* an incredible example of the new, fast railroading.

We've made up 30 of the 46 minutes. We're now 44 minutes early. But to crack the midnight mark we still need to gain another 46 minutes. And the storm-wrapped Alleghenies lie ahead.

It's now up to our new engineer, a keen fellow named H. H. Neal. Cool as a cucumber, he opens the throttle. A road foreman who is riding with us smiles. "I don't know this fellow," he says. "But I can tell by the feel of the train right now that he's going to roll." And that's just what Neal did.

12:20 p.m. The tough "Horseshoe Curve" climb ahead. Engineer Neal adjusts his white cap, takes a hard bite on his cigar, and feeds power. Our new locomotive consists of three tough GM "jeeps" which have more power than many bigger "covered wagons."

"Watch our ammeters," says the road foreman.

Normally, we'd been running with 100 to 300 amperes draw. As we hit the mountain wall, the ammeters jump to a red-hot 600. Noise: deafening. Neal keeps looking back. He nurses that train up the mountain, through canyons, over humps, taking advantage of every downgrade. And then we're over—and coasting. Our ammeters settle back to zero.

Abruptly they jump to a hot 450. "He's reversed his current," says the road foreman, "and he's taking us down the mountains fast, on dynamic brakes—faster than he could using only the air brakes."

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Record Ride on New Super-Freight

And so we roll. Engineer Neal had made the mountains seem like nothing. At Pittsburgh, where Neal leaves us, we have gained 12 more minutes and now are 56 minutes ahead of time. But to crack midnight, we need to steal 34 minutes more. Can we do it?

At Pittsburgh we save 10 by a "rolling inspection"—passing the train slowly, without stopping, through a battery of electronic trouble detectors. At Crestline, Ohio, we save 12 minutes more by passing up a fuel stop.

All along the way we see trains stopped to let us go.

9:06 p.m. Ft. Wayne, Ind. We make another crew change, and bore into a storm. Rain and wind lash the big blue trailer. But we roll on without slowing.

And at 11:50 we're racing traffic on the Chicago Skyway. Ahead, we see a red signal. We slow. Then comes a waving light. We cut across the main line, draw up at a yard office and stop. In the office we see the yardmaster already on the phone. He's calling Yale, Chicago Express, and others: "The Jet's in. Come get your trailers."

The time is exactly 11:58 p.m., Central Standard. We've made it by midnight with two minutes to spare. We're an hour and 32 minutes early. Again the Jet has beat its "impossible" schedule and topped its own best record.

At 12:10 the road-tractors, reached by radio from the truck offices, roll into the yard for the boxes. Our "big blue" is first to go. By 12:45 the train is once more empty of piggies.

This amazing Yankee Jet, Bill and I decided, is proving what railroad men can do when given a chance. This train alone has made jobs for 50 enginemen and trainmen, has helped keep jobs for thousands of others. The Jet, we felt, may well mark the dawn of a prosperous new era of high-speed railroading. ■ ■

.....
Next Month: What's happening with tires for '62? Those new two-plies—are they really better, or are the auto makers just saving money? And what's the news on cords, high-speed tires, snow tires? For an up-to-the-minute report, see December PS.
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Dutch Push Back Sea to Get Farmland

[Continued from page 115]

midable task of digging drainage ditches to empty into the canals. Newly drained, the soggy earth can barely support the weight of a man—much less that of conventional machinery. So special 13-ton tractors, whose wide tracks tread more lightly on the ground than a human foot, haul rotary trenching attachments. Chewing out a ditch, a cutter drum hurls the spoil high in the air, and spreads it so widely that a field needs no subsequent leveling.

Out of the past. The thundering machines dig up history, too. They have unearthed sunken sailing vessels and fishing boats, built at the time of Columbus' Santa Maria, which may be the finest examples of early wooden shipbuilding in the world.

A museum at Lelystad preserves nautical relics and others, still older. Its curator, E. W. Berg, showed me a fossilized leg bone of a mammoth of perhaps 100,000 years ago, found in the pit for the Lelystad pumping station. When such prehistoric beasts roamed this region, it was dry land. Not until the Middle Ages did the North Sea break through coastal dunes, swamp the lowland, and form the Zuider Zee. Now the Dutch are getting their lost land back.

Although of good quality, the long-submerged soil is so devoid of life that its natural regeneration would take 100 years. An artificial program of crop rotation, under way in Eastern Flevoland, ripens the soil in four years.

Helicopters sow still-impassable mud flats with reeds—the first sign of returning life. Rapidly growing 6 to 10 feet high, the sturdy plants stifle weeds, and serve as vegetable pumps. By soaking up and evaporating water, they hasten the polder's drying. In a year's time the ground grows firm. The reeds are cut or burned down and the roots plowed under. Then comes a split year of rapeseed and wheat, another of barley and wheat, and finally one of flax, clover, and wheat—and the land is fully arable.

This timetable is staggered. It starts at the highest and driest part of a polder, which slopes gently seaward. Driving from Lelystad toward the mainland, I traveled with time. Newly planted reeds give way to rapeseed, and then to wheat,

CONTINUED

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Dutch Push Back Sea to Get Farmland

as the level of the regained land rises.

Towns, farms, and roads are under construction on the higher ground, whose surface now is hard and dry. Lest houses and buildings settle in the softer ground beneath, they're being built on piles with reinforced-concrete footings.

The skyline of Dronten bristles with scaffolding. A regional center-to-be, it is named after a medieval settlement on the same site. Stores, schools, churches, and rows of neat red-brick houses are going up for its coming population of 10,000. Uninhabited Dronten is a ghost town in reverse—its life is in the future, not in the past.

Colorful flower beds skirt great white sheds of a vast machinery station, a mile away, that stores and services the polder's bulldozers, tractors, and other implements. Touring inland, I saw some of this equipment in action.

Plowing in a big way. A cloud of smoke and dust rose from the far corner of a brown field. Approaching, it materialized into two yellow Cats in tandem, pulling the biggest farm plow I had ever seen. The giant three-furrow claw ripped through a yard of earth and turned it over—mixing layers of loam and sand, and plowing reed stubble under.

Across another field crawled a weird red tractor-drawn machine, piloted by a wooden-shoed driver. With an endless chain of buckets, it dug a narrow trench three to four feet deep. Simultaneously a chute dropped sections of clay pipe along the trench's bottom. The six-man crew, advancing 500 yards an hour, was laying subsoil drain pipes. Just behind the machine, crewmen spread dry peat over the pipes, keeping their loose joints open to accept water seepage when the trench was refilled with earth.

Enough soil pipe to circle the globe, more than 100 million sections, will be laid in the whole polder. Spaced 25 to 80 feet apart, the lines slope downward like a peaked roof, from a field's center line to the drainage ditches.

In this topsy-turvy land, fields are already under crops, though farmers are still to come. So the state harvests the grain meanwhile and stores it in 40 silos at Dronten. The naked countryside is being planted, too, with trees and shrubs—for landscaping, and also to break

winds that sweep across the flat land.

The cost of it all? Staggering, as a lump sum. A single stone in the facing of a dike costs 42 cents; they have to be imported from Belgium and Germany, and it takes 25 to cover a square yard. But for real estate it is cheap. The total cost works out to only \$1,700 an acre, from water to colonized land.

Until the most advanced part of Eastern Flevoland becomes ready for colonization, next year, the government runs the whole show. Then it will rent the farms and buildings to the settlers, and free enterprise will take over.

Eastern Flevoland will be divided into 1,400 farms of 30 to 70 acres each. For every available farm, there are no fewer than 50 applicants. Successful ones are being picked for their vocational skills, health, sound financial standing—and temperament, to fit harmoniously into a new community life.

Thus happily ends a chapter of the long story that began nearly 30 years ago, when the Zuider Zee became Lake Yssel. For the fresh-water lake, and the great North Sea dam that formed it, have made all the rest possible.

Much higher, wider, and stronger than the polder dikes, the outer dam keeps out the sea's storms and tides. Equally important, it excludes the sea's salt—since fresh water for irrigation and livestock is the essence of life.

Building the dam, with its sluice gates and shipping locks, was a five-year fight against the windswept sea. Within a few years after its completion, river-fed Lake Yssel became fresh. To give the lake an outlet, the sluice gates of the dam spill its excess water into the sea daily at low tide, when the sea falls 2½ feet below the lake. In the five to six hours that the gates are kept open, the level of the lake drops a quarter inch, one day's accumulation.

Behind the dam, the gigantic program of making new land has now passed its halfway mark. And the cycle goes on. Already, crews are building the dike for the next polder to be drained—107,500-acre Southern Flevoland, which will emerge in 1967. Finally will come 150,000-acre Markerwaard, due to become dry land in 1980—and the completion of the great Zuider Zee project. ■ ■

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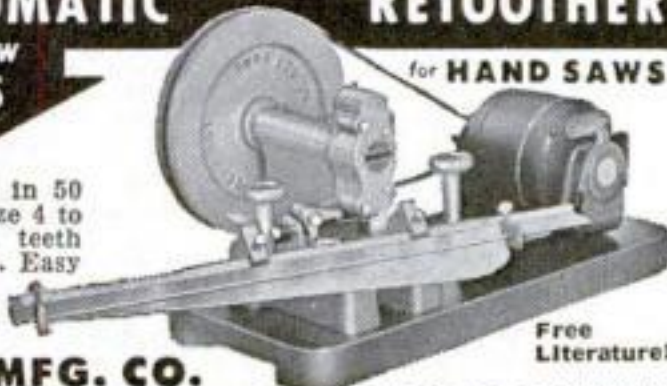
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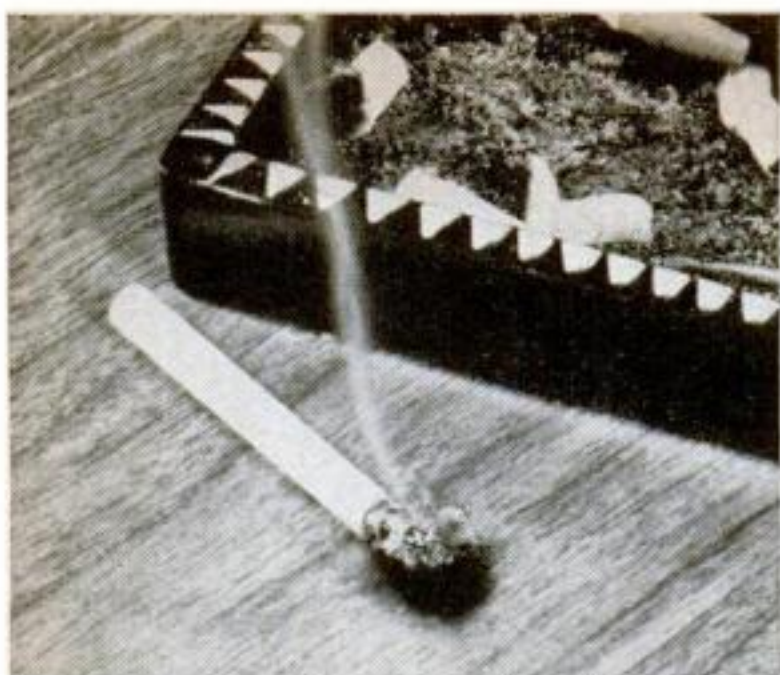
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Home-Shop News Report

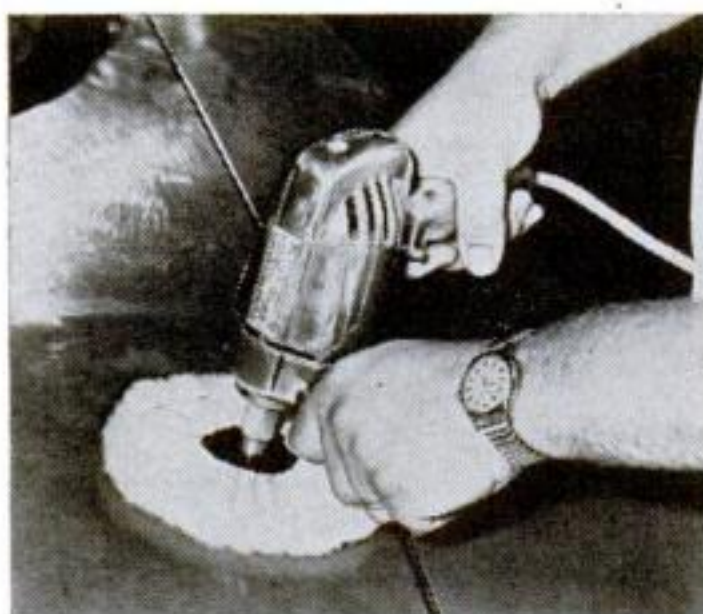
[Continued from page 166]

about as small as a 1/4" drill. Skil does not plan, however, to scatter its interests. "We don't make food mixers or vacuum cleaners," they say, "and we don't buy pickle factories." With new plants here and abroad, they expect to stay strictly in portable tools.

Tool of many names: The Shopsmith multipurpose tool, which has changed hands several times during its illustrious career, has now been taken over in an unusual move by top employees of its former owner, Yuba Power Products of Cincinnati. The new owners plan no major changes in the Shopsmith or other former Yuba tools, but will switch the company name back to the familiar Magna—this time as Magna American Corp.

From small tools to big ones: Portable Electric Tools, until now a small-tool outfit, may be eyeing the big-tool market. Three years ago it tried a portable circular saw that converts to a radial-arm saw. This year, it's promising a full-fledged, self-contained radial-arm saw.

Portable Electric, 1200 E. State, Geneva, Ill., is also bringing out an electric polisher, shown below, that may mark



a trend away from jack-of-all-jobs tools that try to do everything. Designed especially for fine car or furniture finishes, it has a three-amp motor and a low speed of 1,200 r.p.m. to prevent burning. About \$30.

Powered hacksaw cuts wood or metal. Like a giant saber saw, a new reciprocating blade will slice through pipe, thick steel plate, and other tough materials besides heavy lumber. Secret is a power-



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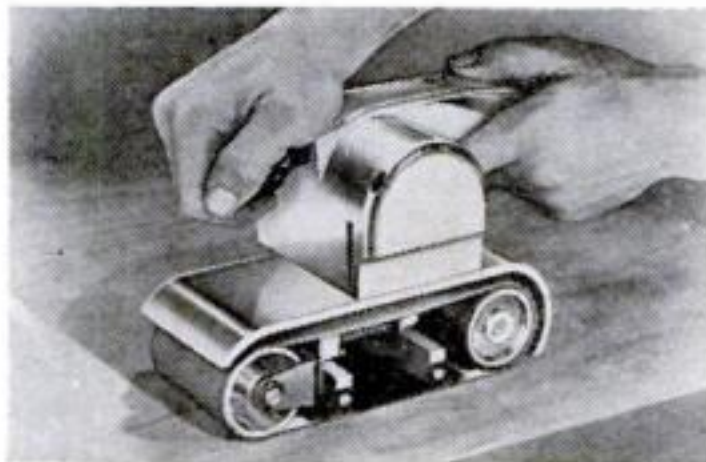
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Home-Shop News Report



ful 1/2-hp. motor in a light aluminum housing. Shown above, it will cut its own starting hole in wood and make flush cuts up to obstructions such as walls and ceilings. Millers Falls Co., Greenfield, Mass. With 12 blades, \$98.

Wen adds a belt sander: A 3" belt sander, designed to give top-grade finishing at a moderate price, has been introduced by Wen Products, Inc., 5810 Northwest Highway, Chicago. The 7-pound tool has



a 4 1/4-amp motor and a belt speed of 850 feet per minute. A special housing is said to trap particles at the rear to provide almost dust-free sanding. About \$45.

Spinner speeds socket wrenches: Attach this crank to a wrench socket and it will spin nuts on or off. The handle



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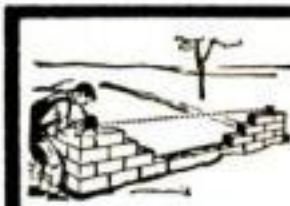
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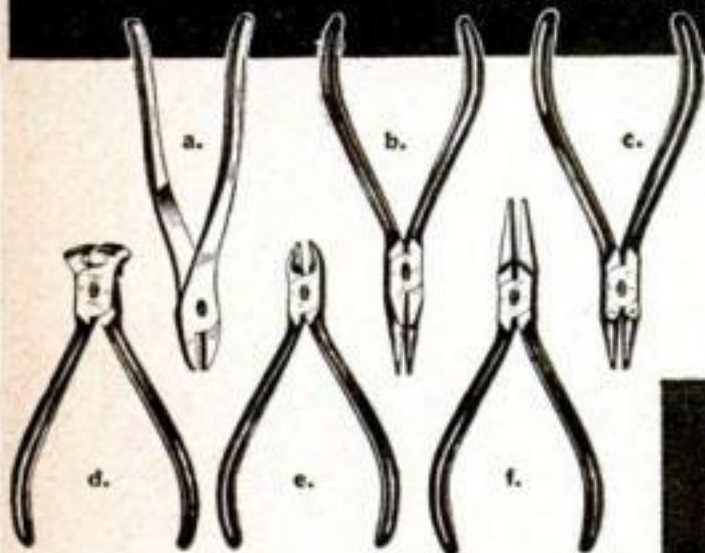
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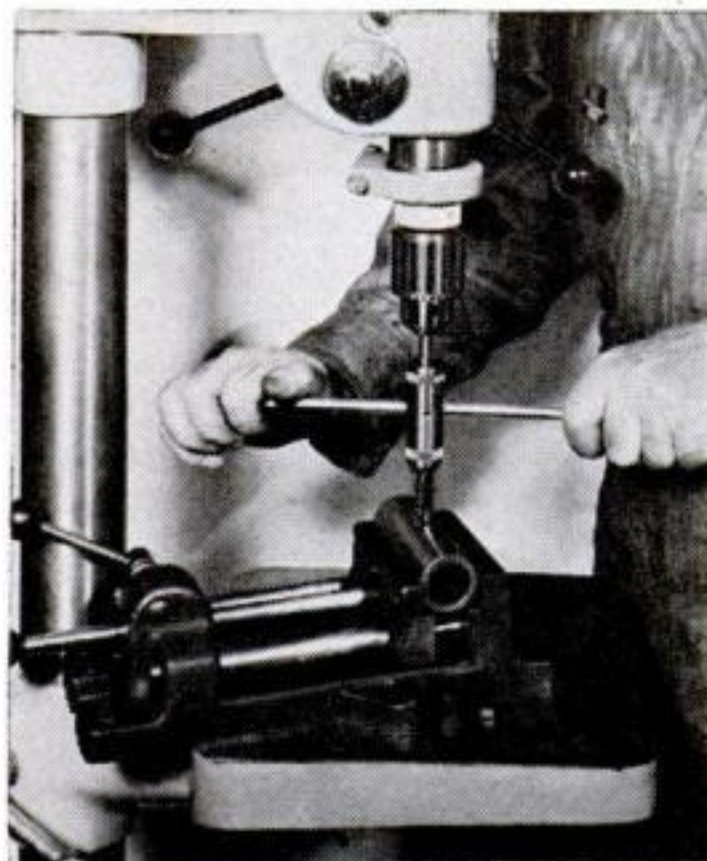
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Home-Shop News Report

is counterweighted for smooth turning and also ratchets in either direction. It fits all $\frac{3}{8}$ "-drive sockets and can be used with an extension for reaching in tight spots. About \$5 from Sears, Roebuck, Chicago.

Precision tapping on a drill press: A new tapping attachment enables you to thread holes accurately on a drill press without the high cost of a tapping head. The tap holder has a hole in the top that rotates around a short pin mounted in

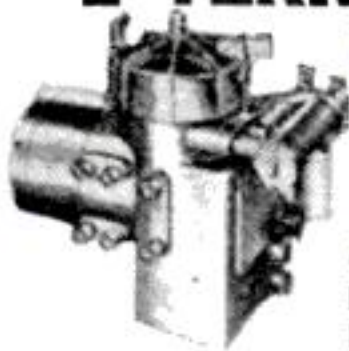


the drill-press chuck, holding the tap vertical as you turn it by hand. The holders, which can be used with any $\frac{3}{8}$ " or larger chuck, come in two sets for taps under $\frac{1}{4}$ " and from $\frac{1}{4}$ " to $\frac{1}{2}$ ". They sell for about \$9 a set from the Boice-Crane Co., 930 West Central Ave., Toledo, Ohio.

Mechanical hands free yours: Bolted to a bench, this pair of cam-locking jaws enables you to clamp odd-shaped objects in any position for welding, soldering, painting, or other work. Four ball joints at the wrists and elbows let the hands swivel and lock at any angle. Apalt Specialties, Box 431, Oakdale, N. Y., sells the tool for about \$13.



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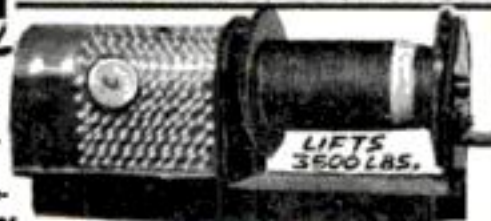
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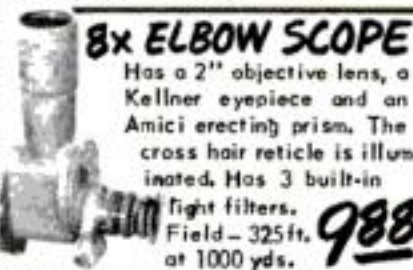
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Fire Detectives Track Down Arson

[Continued from page 69]

The more subtle criminal may tamper with heating and cooking apparatus. A seemingly accidental leak can produce enough fuel vapor or liquid to be ignited by a single match tossed through a window. In these cases, careful inspection of the equipment is needed.

The common candle is a favorite tool of the fire setter, because it supposedly destroys itself in a fire. It burns down and ignites the trailer—rope, paper, or cloth—which in turn ignites the "plant," or container of combustible liquid. However, paraffin and wax leave a readily identifiable residue that is often sufficient for a conviction.

The "clever" arsonist may use the cigarette-match combination in carrying out his crime. As the cigarette burns down, it ignites the match head, which sets off the "plant." The time a cigarette takes to burn down to the point of ignition lets the criminal escape and be seen somewhere else when the fire starts. However, intent is usually obvious to the fire investigator, since the cigarette leaves a trail on the surface on which it burned, as does the flash of the igniting match.

A sophisticated arsonist may even try to balance chemical containers and run-off pipes in such a way that a combustible mixing of the chemicals takes place. Or he may focus a magnifying glass or ordinary pair of prescription lenses so that sunlight eventually burns through a pile of paper or other combustibles.

Perhaps the most diabolical fire-starting devices are the Rube Goldberg inventions of the mechanically inclined arsonist.

"The electric iron," says the National Fire Protection Association, "is perhaps the most abused. Conditions surrounding the start of such fires are intended to appear innocent due to the fact that electric irons are frequently left turned on inadvertently and often cause purely accidental fires. Electric heaters, toasters, soldering irons, curlers, light bulbs, and, lately, clock radios in combination with these items, have all been used in similar schemes. Also, deliberately overloaded electrical circuits, after removal of protective fuses, are used in arson attempts."

"Seldom," says John Kennedy, one of the nation's best-known arson investi-

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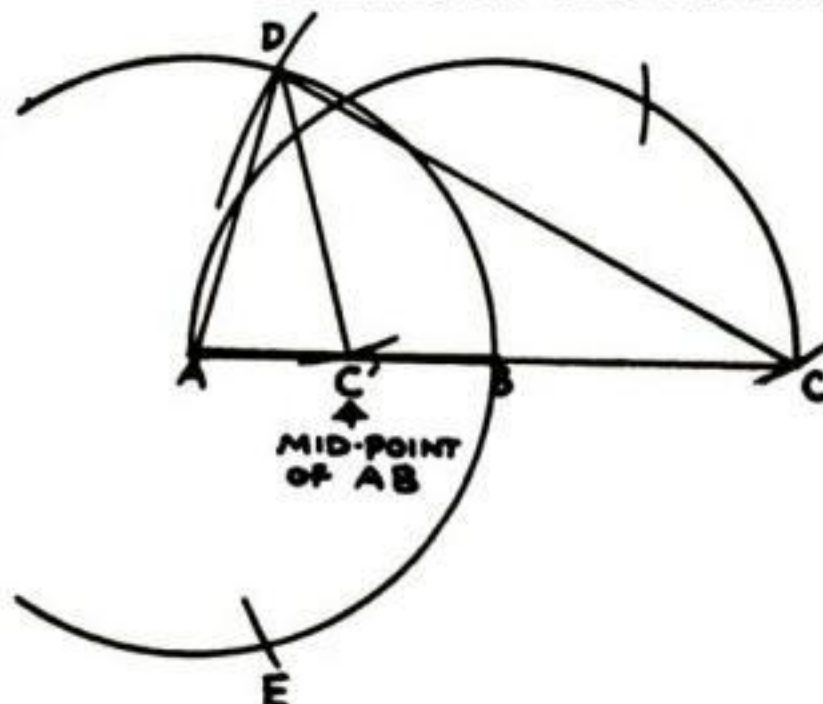
Fire Detectives Track Down Arson

gators and the nemesis of thousands of convicted firebugs, "does the arsonist set the perfect fire. When he thinks he has, the determined fire investigator invariably finds the suspicious charring, the ink-blob outline of a combustible liquid on the floor, or spots of candle wax, and the criminal's days are numbered."

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Answer to last month's Puzzle of the Month



To bisect the line segment AB with a compass alone: With B as center, construct a semicircle of radius AB. The point C is found exactly by laying out three consecutive arcs from point A. Now, with A as center, construct a circle of radius AB. From C swing out an arc of radius AC that intersects the circle at points D and E. Now an arc of radius AB with D as center intersects AB at its mid-point. Why? You have in effect constructed two similar isosceles triangles (ADC' and ADC) whose sides are in the ratio of 1 to 2.

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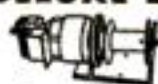
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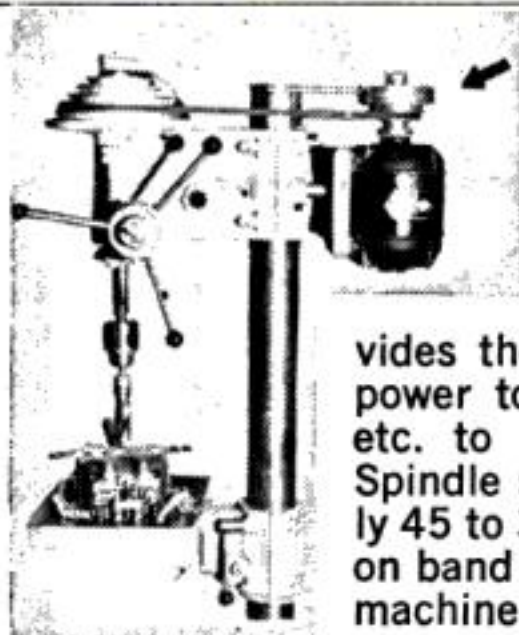
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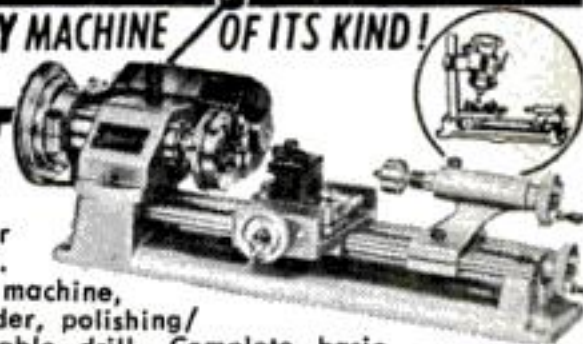
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